Heating and Ventilating

For Engineers and Contractors Controlling the Design, Specification, Installation and Maintenance of Heating, Ventilating and Air Conditioning

Volume 32 | JULY, 1935 | Number 7

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Published Monthly by

THE INDUSTRIAL PRESS, 148 LAFAYETTE STREET, NEW YORK

WESTERN OFFICE: 228 NORTH LA SALLE ST., CHICAGO

ROBERT B. LUCHARS, President
EDGAR A. BECKER, Vice-Pres. and Treasurer
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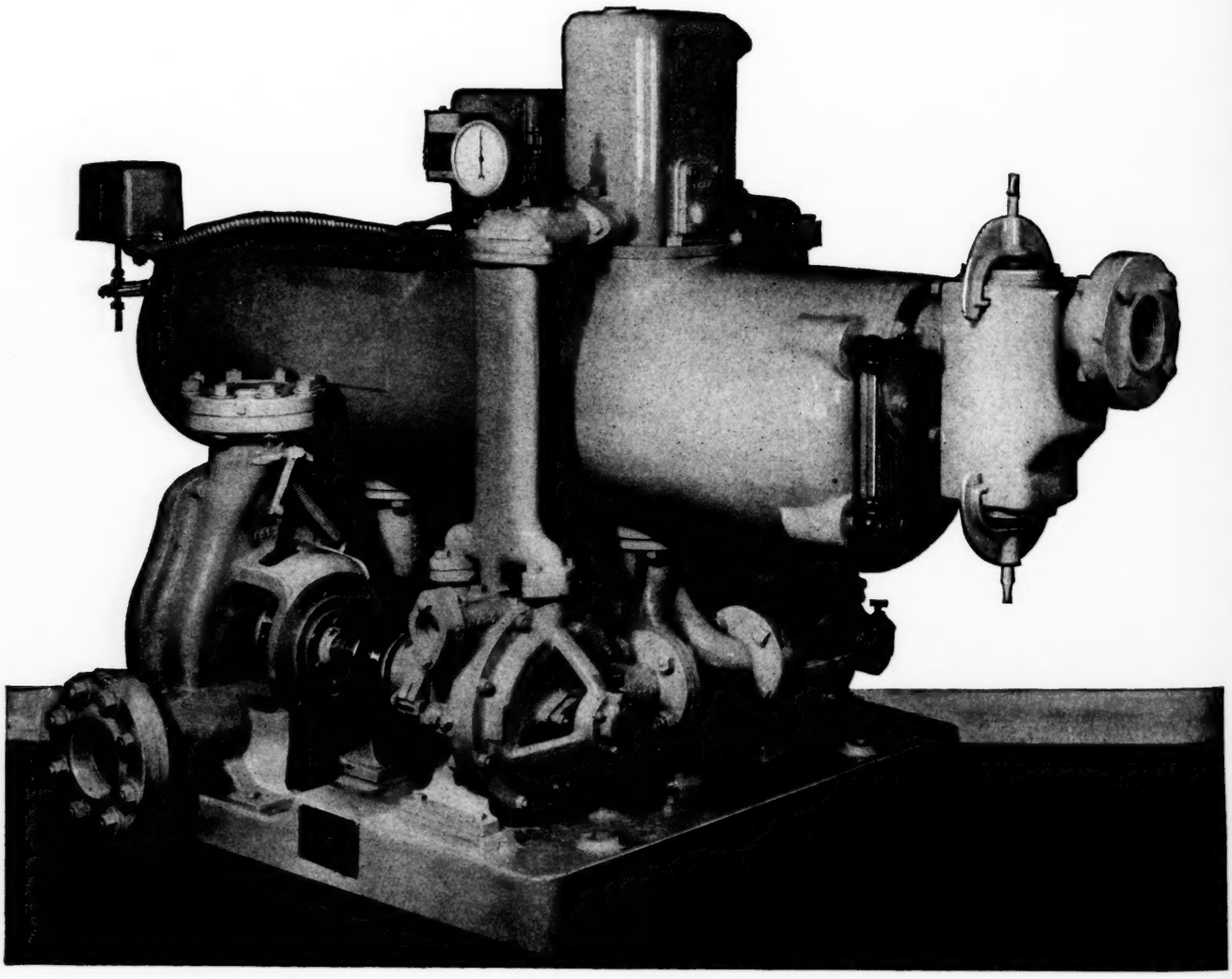
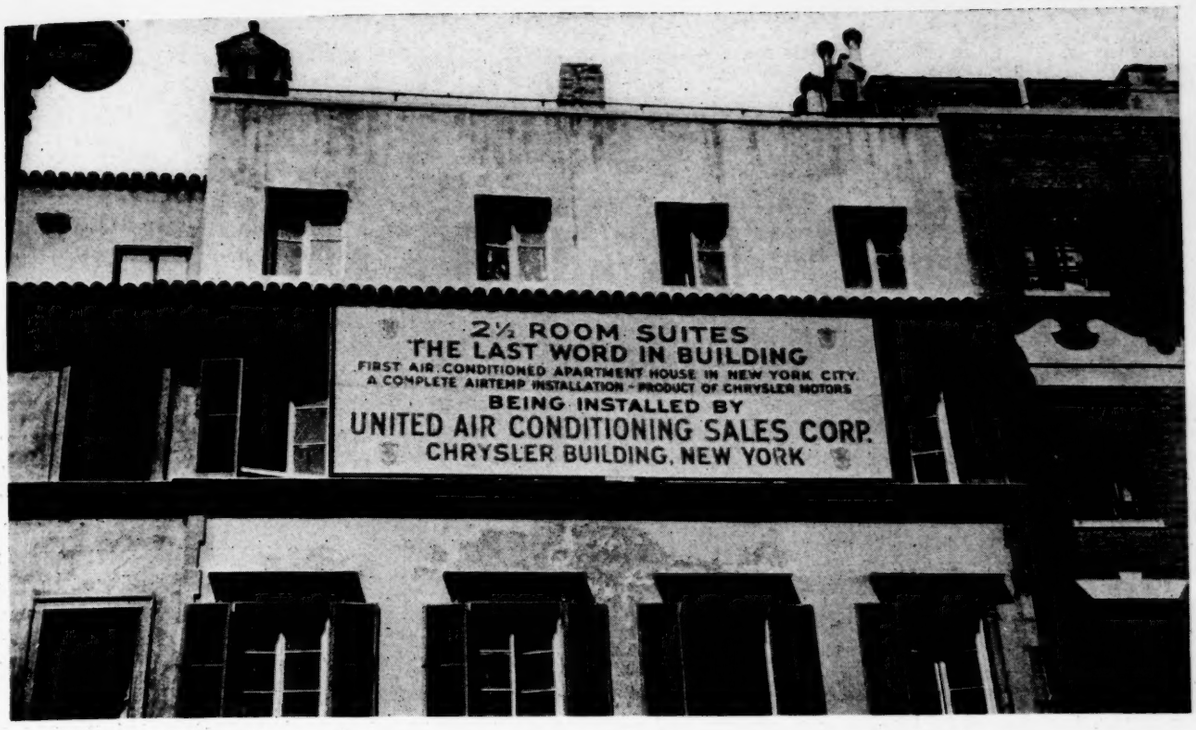



2½ ROOM SUITES
THE LAST WORD IN BUILDING
FIRST AIR-CONDITIONED APARTMENT HOUSE IN NEW YORK CITY
A COMPLETE AIRTEMP INSTALLATION - PRODUCT OF CHRYSLER MOTORS
BEING INSTALLED BY
UNITED AIR CONDITIONING SALES CORP.
CHRYSLER BUILDING, NEW YORK

Upper three floors of the first air conditioned apartment house, New York, with sign advertising air conditioned feature

The First Completely Air Conditioned Apartment House

ONE of the most noteworthy instances of air conditioning in remodeled buildings in New York City is in a modernized apartment dwelling at 125 East 54th Street. Formerly this structure had but a single apartment on each of its four floors, besides an English basement. The new owner, catching the current trend towards smaller apartments and cafe accommodations, has transformed the upper four floors into 2½-room apartments. There are two apartments per floor, or eight for the entire building.

With an eye to extra return on the investment, the English basement was changed into what is known as a "night club." The room, with dance orchestra platform at one end, is about 45 ft. wide by 90 ft. long and will be used as an all-hour restaurant and night cafe. A small bar was installed in the main lobby, through which one must pass to reach the night club. Off the lobby there also are comfort rooms and a cloak room. Residents may reach their apartments via a separate entrance if they desire. Some slight alterations are planned for the front exterior and, when completed, the building will be in complete harmony with adjacent buildings, which almost without exception also are apartment residences of the better class.

It would have been difficult, if not impossible, to have installed the air conditioning system now nearly ready for operation had not structural modernization permitted the installation of the mechanical apparatus and air distribution ducts which are an important feature of the layout.

A study of conditions urged engineers of The United Air Conditioning Corp., New York, and the contractors to offer fan-driven units. As distinguished from other types of apparatus, the units selected resemble what sometimes are referred to as "schoolroom" units in that twin fans take their supply through dry wafer filters, then pass the air upwards over tubular reverse fluid coils, thence to supply ducts for delivery at desired points. One might further describe the units used by stating that they represent a modification of room cabinets without sheet metal enclosures.

Perhaps the outstanding feature of the building's conditioning arrangement is the treatment of individual apartments, which, as already stated, comprise a living and a bed chamber, each about 20 ft. by 20 ft., a fairly good sized kitchenette and a bathroom, with necessary closets. In the floors of closets, the latter in each instance being located near bathrooms or kitchens, air conditioning units were set. As the apparatus is at the bottom of closets the upper space can be used for storage.

Behind and slightly above the fans are the coils, to be considered as integral parts of units because abbreviated sheet metal casings house both fans and coils. The fan inlets, however, are uncovered.

In front of conditioner units, of which there is one

for each of the eight apartments, is a recirculation grille. This is 24 in. by 30 in. in size and is located in the interior wall of the living room at the floor. The fans, having discharged the air over the coils, which contain hot water under pump pressure in winter and cold water, also under pressure, in summer, deliver the conditioned air to concealed ducts that terminate in wall grilles, one opening into each room.

These conditioned air grilles are near ceilings in all cases. Living and bed chamber grilles are 10 in. by 20 in. each, those serving kitchen and bathroom 6 in. by 6 in. each. Thus each apartment is independently conditioned and responds to individual thermostatic controls according to the wishes of tenants.

To supplement the foregoing is a comprehensive exhaust system for all toilets and kitchenettes. A single trunk duct with branches and a single fan serve all such rooms in the building. Kitchen exhaust grilles are near ceilings, while toilet room exhaust grilles are about 3 ft. above the floor and near seats. Grilles are 4 in. by 6 in. Odors are exhausted by cased fan to the atmosphere above the roof.

As a variation of the equipment just outlined, each of the two first floor apartments has a recessed cast iron radiator, faced by 4 ft. by 4 ft. grilles, this radiation being in front halls. There also is in the same halls an extra conditioned air grille near the ceiling, size being 10 in. by 20 in. each. Piping to and from all apartment conditioner unit-coils is cross connected and valved so that one may, according to season, change from hot to cold or vice versa simply by manipulation of hand valves. All piping is of brass with individual unit branch lines of ½-in. size.

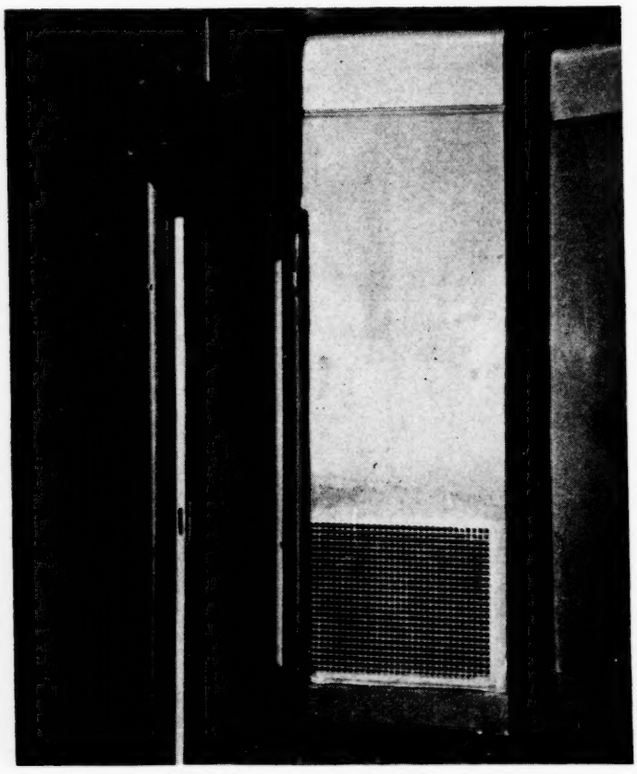
Drainage of condensate from exteriors of unit coils, when used for cooling, is by ½-in. pipe line to the sewer. Hot water radiation return from unit coils goes to a six-section cast iron heating plant in the basement.

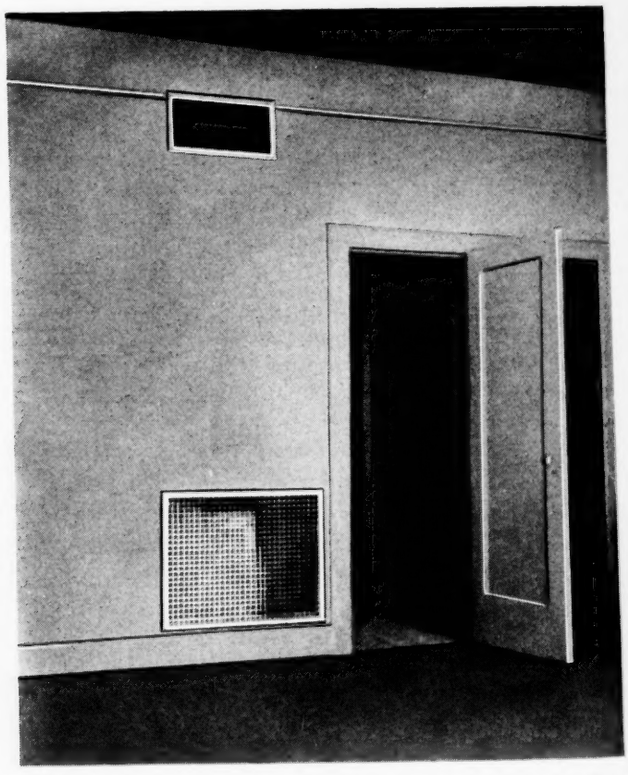
The kitchen that serves the restaurant requirements of the night club is directly beneath the latter and also is air conditioned. The large cased fan that supplies conditioned air both to the club and to the kitchen is in the same room as the oil-fired water heater and its 1,000-gal. horizontal storage tank. This heater not alone furnishes hot water for all space heating but also supplies hot water for the domestic requirements of tenants.

From an air conditioning viewpoint, treatment of the night club parallels that of the apartments in interest. The system here installed might be divided into three features. First, is the large duct some 36 in. wide by 24 in. deep that passes along one entire side of the room adjacent to the ceiling. In the inward side, or face, of this duct are 16 supply grilles each 6 in. by 20 in. and 5 ft. apart. Through these warm air will be delivered in winter and cool air in summer.

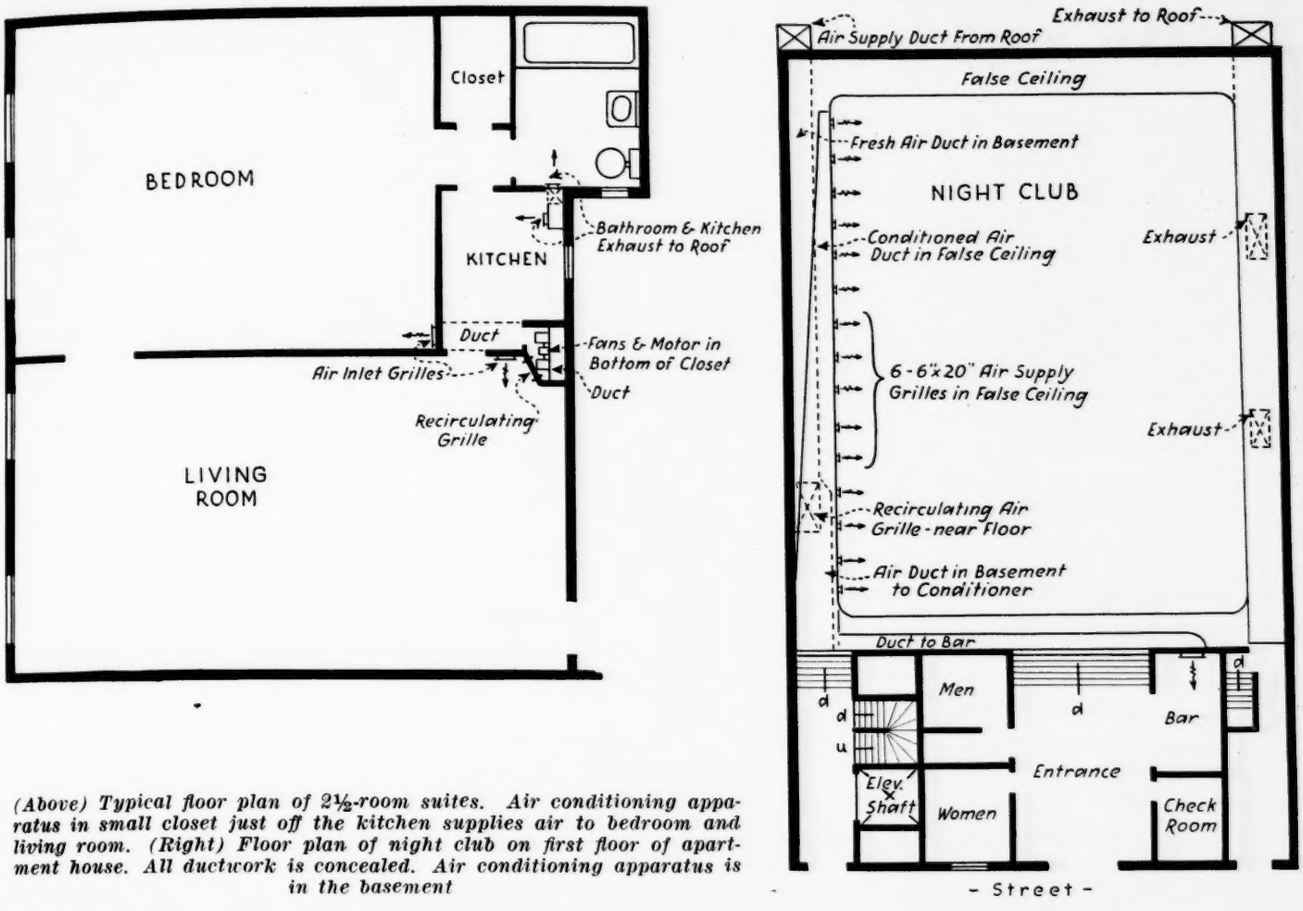
Necessary coils of the duplex-service type, as already described, are installed in a large duct near a cased supply fan in what is known as the fan room. These coils also are cross connected so they can be used either for heating or cooling.

At the floor line and towards the front, or entrance, end of the night club is a large grille for the exhaust of room air for recirculation. This recirculation grille, however, furnishes only two-thirds of the air supply





Two arrangements of supply and exhaust grilles used in the apartments. Fans, cooling and heating coils are in lower portion of closet behind the lower grille which is for recirculating air. Upper grille is for conditioned air and is connected by duct-work to the apparatus in the lower portion of the closet



(Above) Typical floor plan of 2½-room suites. Air conditioning apparatus in small closet just off the kitchen supplies air to bedroom and living room. (Right) Floor plan of night club on first floor of apartment house. All ductwork is concealed. Air conditioning apparatus is in the basement

handled by the supply fan, the remainder being outside air taken from above the roof.

To complete the club equipment is another large duct on the opposite side of the room from the conditioning duct and which also runs along the entire long side. Into the bottom of this, which is an exhaust duct, are two grilles 24 in. by 24 in. each for the elimination of smoke and to improve general air circulation in the room. This duct joins the exhaust duct of the kitchen below, the combined exhaust then being discharged outdoors above the club roof.

The elaborateness of the equipment installed in this modernized building is further evidenced in the fact that small rooms have not been neglected. For example, there is the 9 in. by 12 in. duct, some 90 ft. long, that exhausts heat and odors from the fan, or machine, room and discharges above the roof. Then there are additional air conditioning and ventilating accommodations for a bar in the lobby.

In the interior wall, above the bar, is a 6 in. by 20 in. grille for the delivery of warm air, in winter, and cool air, in summer, to match the general plan of conditioning in the remainder of the building. Also the ceiling of the lobby, between the bar and the cloak room, is a ceiling grille 10 in. by 30 in. for conditioned air, while one finds a 24 in. by 24 in. wall grille in the men's toilet directly across the lobby from the cloak room. Still another exhaust grille was installed in the women's room adjacent, ducts serving the latter two rooms joining the toilet and bathroom exhaust ducts of apartments and discharging above the roof.

As complete modernization of the building will not be effected until early autumn the compressor intended to cool the residential sections of the building probably will not be installed until spring. The compressor and water cooling equipment that serve the night club, lobby and other miscellaneous, minor requirements are, however, now in process of being connected and are of 15 tons capacity, with a 15-hp. motor. Water heater, fans and ducts are practically ready to operate as we go to press.

Of no small importance in connection with this air conditioning and ventilation contract is the emphasis placed by the owner on the benefits. He considered the desirability of making the investment for some time before going ahead with the work. As this is said to be the first all-air-conditioned apartment building in this city the owner can be regarded as a pioneer.

He had no hesitancy in ordering conditioning for the night club and ventilation for parts of the structure below the first floor but used testing tactics to learn whether there would be importance enough attached by tenants to air conditioning of the residential apartments to warrant the cost. Consequently, the owner caused to be publicized the fact that residential conditioning would be furnished. Had no interest been exhibited by prospective tenants it is likely that the matter would have been dropped until a later date. The news elicited marked interest, however, and sev-

(Concluded on page 76)

Air Conditioning for California Homes[1]

By B. M. WOODS† and B. F. RABER‡

IN air conditioning, whether for heating or for cooling, the fundamental information needed by the designer always includes the kind of air available on the outside and the kind to be provided in the house. The designer will ask "What are the initial temperature, humidity, and degree of purity of the atmosphere; what final values of these same data are to be provided, and what air movement is desired or is permissible?" The type of equipment suitable for any home is really affected as much by the weather of the region in question as by any other single factor.

Analysis of weather reports from stations scattered throughout California shows that there is a very considerable region over the whole of which the maximum daily temperature for July is above 90°. July is, in general, the hottest month of the year in California, and 90° is an average maximum above which comfort cooling is strongly indicated as desirable.

A study of these weather reports and of the map of the state suggests the delineation of zones in which conditions appear to be similar. The region above referred to, over which the average daily maximum temperature for July is above 90°, includes practically all of the area of the interior valleys of California, together with a considerable portion of the interior mountainous region of southern California.

The entire coastal and most of the delta area lies outside of this zone I. Analysis with reference to the humidity encountered, as well as the temperature, indicates the desirability of dividing the coastal region into two zones. That portion north of Santa Barbara is strongly affected by the cool waters of the Japan current off-shore. It is labeled zone III. The portion from Santa Barbara south, has high relative humidity, but it has higher temperatures. The southern coastal region is labeled zone II.

Since these assignments of zones are made arbitrarily from average conditions for the region some exceptions are to be expected.

The Question of Economy

In this, as in all equipment problems, the question of cost must be kept constantly in the foreground. Where the need for summer cooling is not great, the justifiable expenditure for obtaining results may similarly be small. In certain communities, also, weather conditions and the availability of cheap cold water and low electric rates may make possible relatively inexpensive cooling systems.

As a preliminary guide, the assumption has been made that "ultimately the homeowner may be willing to pay as much per year for cooling as he now pays for heating." In climates where the warm season lasts most of the year, the homeowner will probably be willing to pay more; in climates where the winter season is long and cold, the situation will be reversed. For the central valleys of California the rule may prove a fair one. A number of commercial installations in the valley climate of California have shown approximate equality between annual heating and cooling charges. A study of Fig. 8 indicates that the initial cost of a cooling system, or perhaps of a combined system, is at present about that of the family automobile. Doubt-

[1]Abstracted from Bulletin 589, Agricultural Experiment Station, College of Agriculture, University of California, Berkeley, Calif.
†Professor of Mechanical Engineering.
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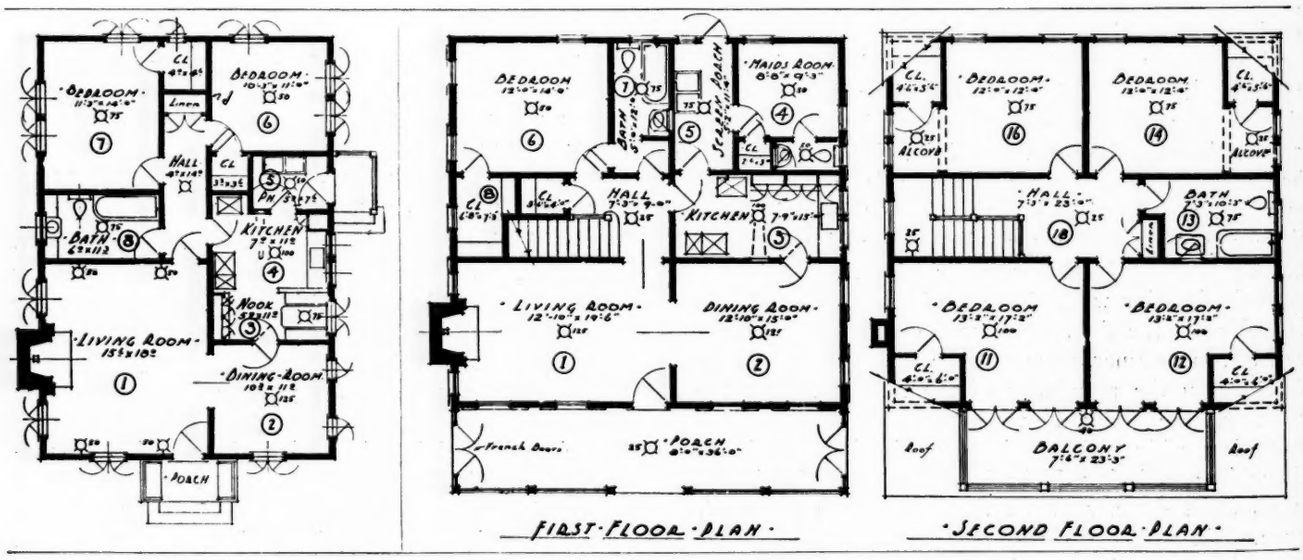

Floor plans of residences used as basis of comparisons of cost of cooling equipment and effect of insulation. Fig. 1 (Left). One-story cottage. Fig. 2 (Right). Two-story house.

less, with increased production and standardization of equipment, the initial cost can be reduced.

Sample Houses

Two sample houses are used in this bulletin as the basis of discussions and comparisons of such items as the effect of insulation and the cost of the equipments for summer cooling. The assumed floor plan of the first house, a typical five-room cottage, is shown in Fig. 1, the general external appearance in Figs. 4, 5, 6, and 7. The second sample house is a two-story, eight-room home. The floor plans are given in Fig. 2.

Both houses are typical California homes. The usual frame of 2 × 4 in. wooden studding is assumed to be sealed outside by fir sheathing, building paper, and redwood siding, and inside by wood lath and plaster. The roof design in each case is a simple gable type with wooden rafters and roof sheathing and cedar shingles. The floors consist of the usual 1-in. pine subflooring and 3/8-in. oak-finish flooring, with building paper between. Basements, adequate in size to contain the necessary equipment, are assumed under the houses.

When referred to as insulated houses, the constructions are considered not modified, except by the additions of insulation in the spaces between the studding, and between the ceiling joists of the attic. The insulating material chosen is shredded redwood bark, so applied as to give a weight of approximately 1,500 lb. per 1,000 sq. ft. of wall or ceiling surface that is insulated. No shredded redwood bark was considered applied below the lower floors, because of the assumption that the basements would be closed and below earth grade, and, therefore, not subjected to the outside air temperatures that are effective on the wooden walls of the structures.

Insulation

Computations for the sample houses show that in such a cottage, uninsulated, more than 40% of the heat enters through the roof. In Fig. 3 comparisons for the cottage have been made for the cooling season and for the heating season. For the cooling season the heat which gains admission through the house is of primary interest. This is tabulated in the two charts under the heading "Heat Gained." Two cases are shown. With no insulation and single-glass, unshaded windows, the left bar, *A*, shows the proportions of heat gained from the walls, roof, window glass, sun effect on the glass, and the air change required to provide fresh air for the occupants. Corresponding reduced amounts with walls and ceilings insulated, double glass in the windows, outside shades, such as awnings for the windows, are shown in the second bar, *B*. The saving possible by such insulation is striking.

Bars *C*, *D*, and *E* indicate the heat loss for the cottage under different conditions of insulation during the heating season. Bar *C* shows the loss from the uninsulated house, and the various components of the total loss are indicated. Bar *D*, drawn to the same scale, shows the total loss and the components if the house is insulated. The shaded portion indicates the resulting percentage saving, based on the total loss from the

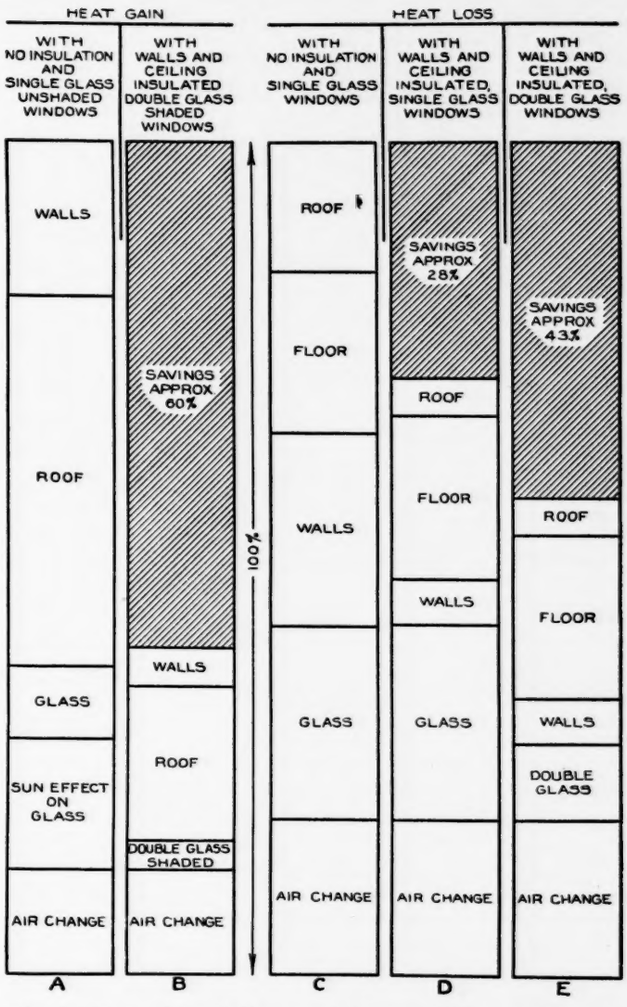

Fig. 3. Effect of insulation on cottage. Savings during summer shown by columns A when cottage is not insulated or shaded, B when insulated and windows shaded. Last three columns show savings during winter. C, not insulated; D with insulation; E with insulation and double glass. Total heat quantities in bars A and C are not equal.

uninsulated house. Bar *E* is for the same conditions as *D*, except that double glass was used in the windows.

The total heat lost from the uninsulated house in the heating season (bar *C*) is not the same in amount as the total heat gained through the uninsulated house in the cooling season (bar *A*). The basis of percentage in bars *A* and *B* is therefore different from that in bars *C*, *D*, and *E*, and comparisons between the two groups as to total heat quantities are not possible from the data given in Fig. 3.

Mechanical Equipment

To obtain a drop of 10°-20° between the outside and inside air for comfort cooling of homes, there are, broadly speaking, two general classifications of equipment. One operates mainly by the cooling effect due either to circulation of air which is cooler than the spaces through which it is to be circulated, or to the use of water sprays either applied directly to the air as in washers, or indirectly through heat exchangers. This classification is usually characterized by low operating costs. Attention, however, should be paid to the amount of water, if it is used, since this may con-

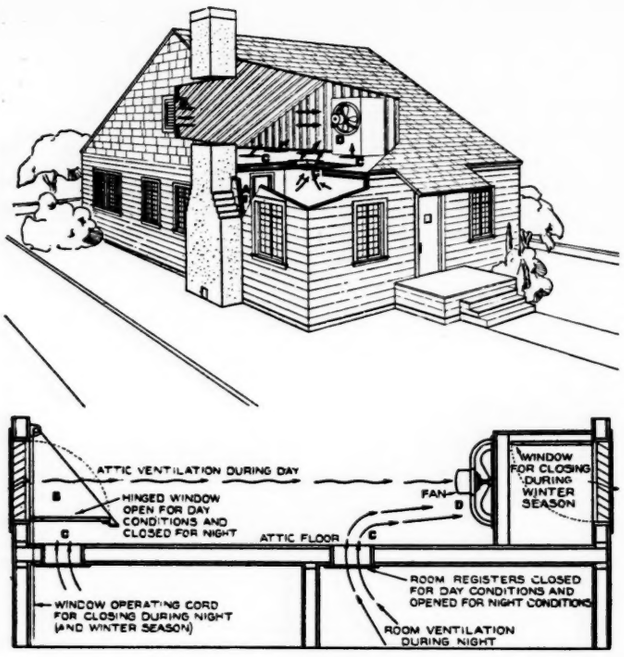
ATTIC VENTILATION DURING DAY
HINGED WINDOW OPEN FOR DAY CONDITIONS AND CLOSED FOR NIGHT
ATTIC FLOOR
FAN
WINDOW FOR CLOSING DURING WINTER SEASON
ROOM REGISTERS CLOSED FOR DAY CONDITIONS AND OPENED FOR NIGHT CONDITIONS
WINDOW OPERATING CORD FOR CLOSING DURING NIGHT (AND WINTER SEASON)
ROOM VENTILATION DURING NIGHT

Fig. 4. Equipment for attic ventilation with night air circulation.

stitute a considerable fraction of the operating expense. Also, one should make certain that the resultant air is of acceptable temperature and humidity.

In the second classification, mechanical power is applied to a refrigerating fluid with the aid of compressors and evaporators to provide a refrigerating system. An equivalent effect may be realized by a combination of the first system with ice, obtaining approximately the same results, but with less accurate control. At the present time ingenious developments are taking place in both classifications.

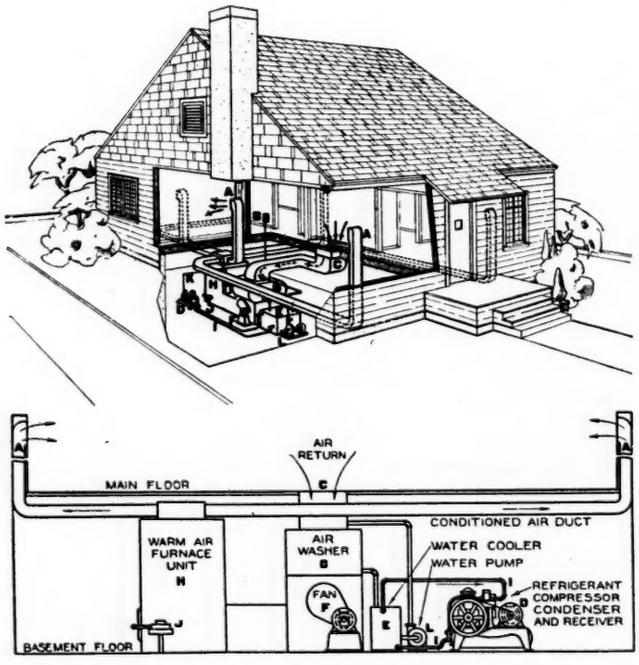

Fig. 5. Equipment for all-year air conditioning, using warm-air furnace for heating and refrigerating unit for cooling.

Application of Equipment to the Sample Cottage

Figs. 4, 5, 6, and 7 illustrate four typical systems that might be installed in the cottage, floor plans of which are given in Fig. 1. The systems shown are illustrative of available equipment. They show only a few of the many possible combinations. They do not show every detail or the limit of equipment for any particular system.

Initial and Operating Costs of Typical Cooling Systems

The cost of systems of equipment completely installed and connected, ready for operation, will vary with differences in time, location, labor costs, installing conditions, and quality, capacity, and type of equipment. Installing conditions include type of construction, insulation, available space, and many other variables. Therefore, any general statement as to approximate costs of typical equipment should always be considered subject to adjustment for a specific set of conditions. Nevertheless, a statement of approximate costs is valuable in making comparisons of installations and in giving an idea of budgeting provisions.

Initial Costs—The bar chart, Fig. 8, indicates initial costs for the year 1934, as given by California firms, without freight or transportation inclusions from San Francisco, for seven different typical summer cooling systems, as recommended by these firms, for the cottage and for the two-story house, previously referred to in this bulletin. For each system, the first long bar shows bid cost installed and connected in the cottage, when insulated, the second long bar the same for the cottage uninsulated, the third long bar for the two-story house insulated, and the fourth long bar for the two-story house uninsulated.

The firms were asked to select no larger capacity of their equipments than would be necessary to guarantee a maximum drop of 17° from outside air temperature to that inside of the spaces to be cooled. Of course, such guarantee was not possible with system *A* because its results depend upon night air temperatures, nor with systems *B*, *C*, or *D* because these depend upon both temperature and humidity of the outside air for the final results. Only with systems *E*, *F*, and *G* was it possible to guarantee the specified drop of 17° under any and all of those outside air conditions requiring cooling that are encountered in California.

Whenever the system or bid required, uniform allowances for piping, wiring, registers, and duct work were added, respectively, of $15, $20, $35, and $50 for the cottage, and $15, $20, $50, and $75, respectively, for the two-story house. All costs are for non-automatic, or manual control, except for system *G*, where complete automatic thermostat control was included.

System *A*, Fig. 8, includes the installation of registers and fan as outlined in Fig. 4 for the purpose of cooling the house by circulation of air during the night, and counteracting the sun effect on the roof by circulation of air through the attic during the day. This simplest of all systems will evidently give best results

in localities where night temperatures are decidedly lower than those during the day.

System *B* includes the installation of a simple fan and air washer with ducts and registers. This system gives best results in the dry regions of zone I, where addition of moisture to the incoming air is desirable. If the system is a recirculating one, excessive moisture addition may occur.

System *C* consists in the installation of fin-type cooling surfaces, with cooling tower, a fan, and ducts with registers. This type of system will give best results where humidity is low enough to allow a cooling tower to show a reasonable drop in temperature. Fin-type cooling surfaces allow recirculation of air in the house without cumulative increase in humidity, whereas a simple air washer tends to build up the inside humidity to intolerably high values with recirculation of the room air through the washer.

System *D* includes the installation of an indirect evaporative cooling equipment. Although this is based on a simple air washer for the refrigerating effect, the machine can nevertheless realize the economic advantages of recirculation without cumulative increase of room humidity to very high values. This is accomplished by transferring the refrigerating effect, only, from the washed air stream to the room air stream.

System *E* of Fig. 8 includes the installation of an underground ice tank for cooling water circulated in the room radiators of a combined cooling and hot-water radiator heating system, the radiators and their connecting piping and water heater not being included in the costs as indicated. This cooling equipment is shown by items *A*, *F*, *D*, and *C* of Fig. 6. When the number of days during which cooling is needed in a given season is small, the ice system is a good one to consider. It gives high cooling capacity without high installation cost. A number of successful installations have been made. However, difficulty may be experienced in this case with the formation of a stratum of cold air near the floor, unless means of agitation, such as floor fans, are provided. The trouble is due, of course, to the radiators. It may be remedied by substituting unit coolers with integral fans.

System *F* includes the installation of an air washer, and an ice tank for cooling the spray water of the washer, and requisite registers and ducts. This combination may be useful when high humidities and high temperature prevail, as in zones II and III, because the cold-water spray in the washer tends to reduce humidity in the rooms.

System *G* consists in the installation of a compressor and condenser refrigerating unit, a central fin-type air-cooling coil, blowers, filters and humidifier, and the necessary registers and ducts. Thermostatic control is included in the cost estimates for this equipment. The mechanical systems, based upon the use of refrigerating fluids and the employment of compressors and evaporators, are well known, and present the great advantage of being independent of the outside atmospheric conditions. Much ingenuity is now being shown in the design of mechanical refrigeration systems to make them economically applicable to homes. In a

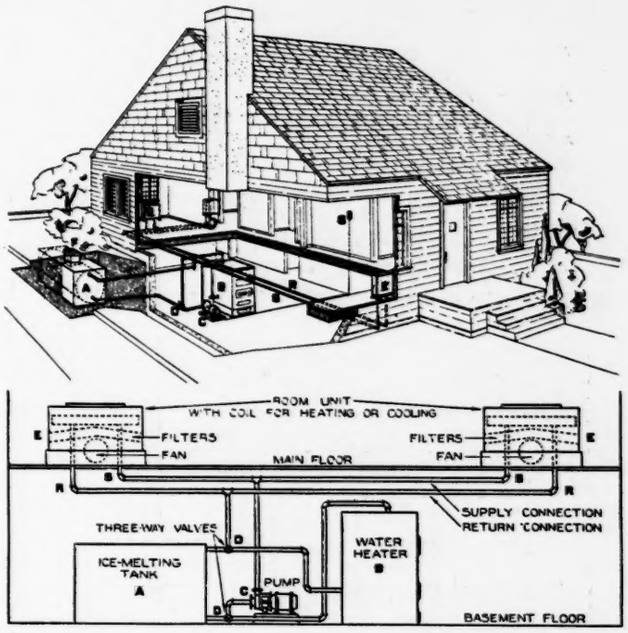

Fig. 6. Equipment for all-year air conditioning, using hot water system for heating and ice melting tank for cooling.

number of cases, they give results which justify the present cost.

Operating Costs.—The estimated operating costs to be expected during a cooling season requiring 1,000 hr. of actual operation are shown by the broad black bars for each of the systems *B* to *G* inclusive, and for each of the four house conditions. System *A*, using fans for cooling at night, is estimated on the basis of 2,000 hr., because this system requires both night and day operation for its fundamental effects, whereas the other systems do not. For the purpose of these estimates, the cost of electric power was taken at 3 cents a kw-hr., water at 50 cents per 1000 cu. ft., and ice at $4.50 a ton.

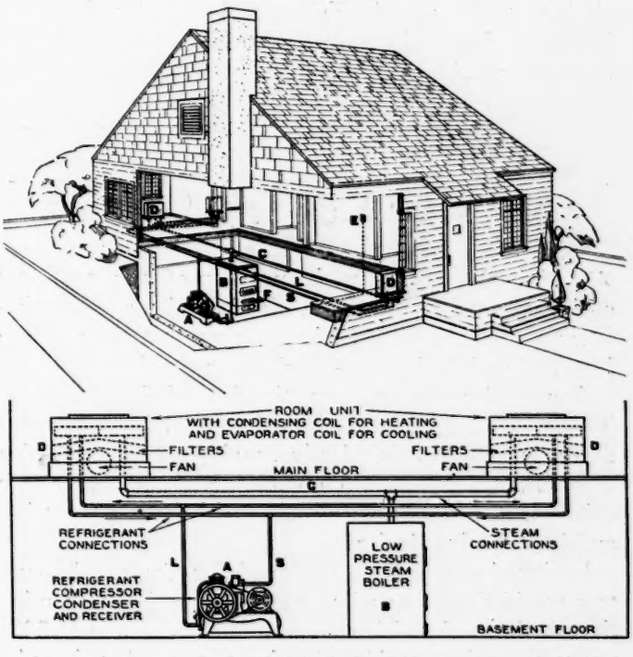

Fig. 7. Equipment for all-year air conditioning, using steam for heating and refrigerating unit for cooling.

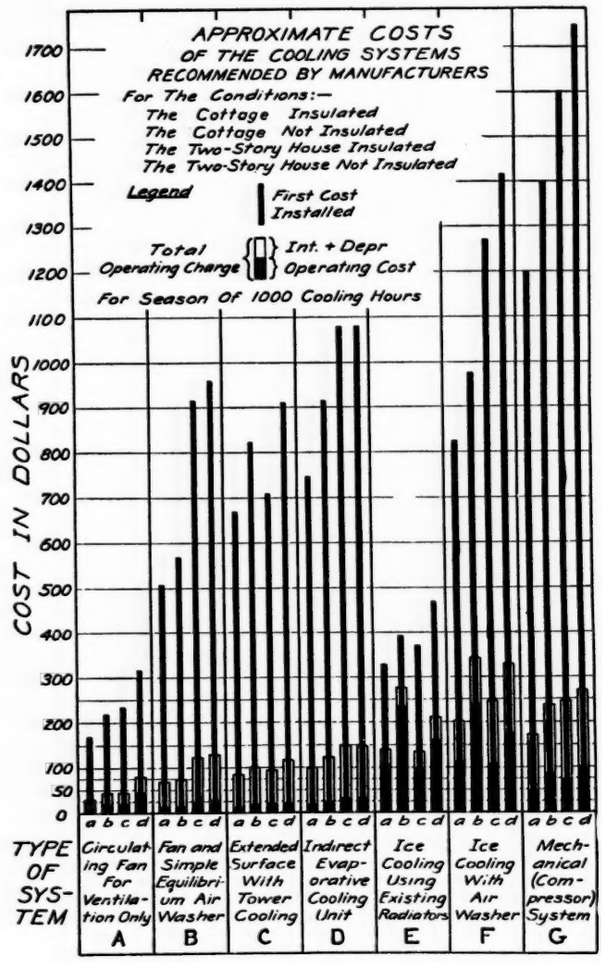

Fig. 8. Comparison of costs for seven different cooling systems, A to G, as applied to the two sample houses. (a) the cottage insulated, (b) the cottage, not insulated, (c) the two-story house insulated, (d) the two-story house, not insulated.

The combined charges for interest at 6% and depreciation at 5% are shown for each case by the white bars, superimposed upon the operating-cost bars. These amounts as shown are for one year. Therefore, the total of operating interest, and depreciation charges is indicated by the top of the white bars.

Cooling systems are commonly installed to reduce the temperature of only a part of the house at a time —for example, a two-story house may be provided with such a system as would cool the downstairs rooms during the day, and the upper rooms during the night. Under certain circumstances small families have been content with a single room cooled and with the relief thus afforded. Accordingly, and as recommended by the firms supplying the cost estimates, the following conditions pertain in the seven systems for which costs are given in Fig. 8.

System *A:* All rooms cooled, for the four house conditions, the extent of cooling effect depending upon the temperature of the night air.

Systems *B, C,* and *D:* Same as *A,* except extent of cooling effect is dependent upon the humidity of the outside air.

Systems *E* and *F:* For the insulated and uninsulated cottage, the rooms selected for cooling were the living room, dining room, breakfast nook, and kitchen, it being understood that at night the cooling effect would be transferred to the sleeping rooms. For the insulated and uninsulated two-story house, the rooms selected for cooling were the living room, dining room, kitchen, and maid's room, with transfer of this cooling effect to second-floor sleeping rooms at night.

System *G:* For both of the insulated houses, the bidding companies elected to cool all rooms. For the uninsulated cottage, the living room, dining room, breakfast nook and kitchen, and bath were selected, and for the uninsulated two-story house, the entire downstairs and one bedroom (room 12 in Fig. 2).

Generally, for systems *A, B, C,* and *D,* it will be noted that the cooling effect is dependent upon uncontrollable atmospheric conditions; for systems *E* and *F,* the cooling effect is dependent upon the amount of ice used, and for system *G,* the cooling effect is dependent upon the amount of electrical energy and of cooling water used.

Air Cooling Optional in New Office Buildings

A NEW approach to the problem of keeping offices cool in summer has been conceived for the latest Rockefeller Center buildings—the Palazzo d'Italia and the International Building—which opened May 1.

A central cooling system, the first of this type ever installed in an office building, has been built into the new structures. It is selective, making it optional with tenants as to whether or not they wish to equip their offices with air cooling units, or with both air cooling and humidifying devices.

Designed especially for Rockefeller Center, the system establishes air cooling on the same basis as utilities like heat, electricity, gas, and water. A trio of 300-ton refrigerating machines has been installed in the subbasement of the International Building and Palazzo d'Italia. These machines will cool water and circulate it at a temperature of about 42° through pipes.

Every office in the new buildings has an outlet to these pipes. Thus, with a constant supply of chilled water available, tenants may, if they choose, install either a small cooling or cooling and humidifying unit. The cooling units consist of a pipe coil and fan. The chilled water is circulated through the pipe coil, cooling the surrounding air which is then blown out into the office by the fan. The unit may also be of the humidifying type with a spray which introduces moisture into the air. This is particularly desirable in winter when the air becomes dry and parched by steam heat. In summertime, however, dehumidification is a result of the cooling process.

Million Dollar Air Conditioning Modernizing Contract

now under way in present Department of Interior Building. A.C. scheduled for new Interior Building. Government jobs active

WASHINGTON—Plans are about completed for the new Department of the Interior building to be erected between 18th and 19th Streets, NW., and C and E Streets. This building, for which an appropriation of $10,000,000 has been made, will be approximately seven stories in height, 574 ft. x 358 ft., with limestone exterior. The project will be carried out under the supervision of the Procurement Division of the Treasury Department. The consulting architect is Waddy B. Wood, 1727 K St., NW., Washington. Bids will be opened on July 19 at 1 p.m. The building will be equipped with a modern air conditioning system.

What is said to be the largest single air conditioning contract ever placed with one company has been awarded to the York Ice Machinery Corporation, at a cost of approximately $1,000,000. The contract calls for a complete air conditioning system for six of the seven floors of the (present) Department of Interior building. The seventh or top floor of the building was air conditioned by York last year.

According to terms of the contract, part of the installation must be finished and operating in time to give some of the building's occupants the benefits of air conditioning this summer. Most of the installation work in offices is being done at night, to avoid interference with the numerous governmental activities which are carried on in the Interior building.

The mechanical equipment includes a refrigerating system with a capacity of 1,000 tons of refrigeration, the air conditioning units for 81 zones into which the building has been divided, and a ventilating system which will circulate 500,000 c.f.m. of conditioned air to the various offices.

A plan to install air conditioning throughout the White House has been turned down by the President because only a few men would receive relief jobs for such a project, he felt. At present seven rooms are air conditioned, by special units, including the family dining room and a few bedrooms. In all but two the system was installed some time ago.

The motion picture laboratory and auditorium of the South building, of the Department of Agriculture, are being air conditioned. The work is under the supervision of the National Park Service, Department of the Interior. Bids were opened on March 9. The three low bidders were: Carrier Engineering Corp., Washington, $96,800 (2%—10 days); Carbondale New York Co., New York, $94,880; Mehring and Hanson Co., Washington, $104,620. The contract was awarded to the Carrier Engineering Corporation.

Bids opened on May 3 disclosed that the two low bidders on the project for air conditioning the U. S. Court House at Jacksonville, Fla., were the York Ice Machinery Corporation, with a bid of $37,736, and the Carrier Engineering Corporation, with a bid of $38,422, with a discount offered of 2% in 10 days. The award was made to the Carrier Engineering Corporation whose bid, considering the discount offered, was the lowest, the award figure being $37,653.56. This job is being carried on under the supervision of the Procurement Division of the U. S. Treasury Department. Work is to be completed in 120 calendar days

The east and west wings of the Administration Building of the Department of Agriculture, Washington, are to be equipped with air conditioning. Bids for this job were opened on June 12. No award has been made as yet, but the low bidders on the project are: Riggs Distler & Co., 216 North Calvert St., Baltimore, $287,287; Carbondale New York Co., $287,850; Carrier Engineering Corporation, $316,400; York Ice Machinery Corporation, $329,862. All bids were submitted with certain alternative bid provisions. The National Park Service, Department of the Interior, is supervising the work.

A. R. Clas, newly appointed director of the Housing Division, P.W.A. Mr. Clas helped Col. Horatio B. Hackett set up the Housing Division

The Carrier Engineering Corporation has been awarded the contract to air condition rooms 3053, 3055, 3057, and 3062 in the Navy Building, at 18th Street and Constitution Avenue. The award figure was $4,973.50. Other contending low bidders included Loughborough Oil Co., $5,609; Frigidaire Corporation, $5,680, and the York Ice Machinery Corporation, $5,927. The National Park Service, Department of the Interior, is in charge of the work for the government.

Bids were opened on June 12 for air conditioning five groups of rooms in the State Department Building at Washington. The low bids submitted were as follows: Carrier Engineering Corporation, $98,245; Riggs, Distler & Co., $117,446, and Mehrig and Hanson, $125,900. No award has been made as yet. The National Park Service, Department of the Interior, is handling the job for the government.

The Loughborough Oil Co., 1703 L St., Washington, has been awarded the contract to equip rooms 2625, 2625 (annex), 2627, 2629, 2631, 2633, 2635, and 3421-2426, inclusive, in the Navy Building, with air conditioning. The contract price was $21,437. The same company also secured the contract for air conditioning rooms 2036, 2038, 2040, 2042, and 2044 in the same building, at a figure of $3,895. Both projects are under the supervision of the National Park Service.

The York Ice Machinery Corporation has been awarded the contract for air conditioning the operating rooms of the Marine Hospital, Baltimore. The award figure was $2,000, the work to be completed in 45 calendar days. The other contending low bidder was Chatard & Norris, Inc., Baltimore, with a bid of $2,140. The Procurement Division of the Treasury Department is in charge for the government.

Under the direction of the National Park Service, Department of the Interior, a ventilating system is to be installed in the blueprint laboratory in the Navy Building, Washington. Bids for this job were opened on June 7. Low bidders included the Central Armature Works, Inc., 625 D Street, NW., Washington, $2,618, and the Loughborough Oil Company, $2,829. The contract was awarded to the Central Armature Works, Inc., at the figure bid.

A ventilating system is being in-

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Papers on Steam Rates, Corrosion, and Steam Jets Feature N.D.H.A. Convention

with 200 district heating engineers in attendance. Feeling of optimism prevails at 26th annual convention

SELDOM if ever has a convention of the National District Heating Association had a program so full of committee reports and papers packed with interesting and concrete data as was the 26th convention held in Philadelphia, June 11-14. Each of the 13 standing committees presented papers in such an array that the total for the four-day session ran to nearly thirty-five technical presentations alone.

With routine reports and addresses by guest speakers, the business program was full from start to finish. Time was still found for a social program arranged by the Philadelphia Electric Company and which included golf, a banquet, and trips to historical sites and points of interest throughout the city. In addition there was an exhibition of products of 20 manufacturers which received much attention and comment, as well as trips to the plants of Warren Webster & Company, Brown Instrument Company, Leeds and Northrup Company, and Yarnall-Waring Company.

A feeling of optimism brought about partly by an inspiring opening address by H. P. Liversidge, vice-president and general manager, Philadelphia Electric Company, partly by an attendance of over 200, reports of a net gain of fifty new members during the year, and association operations resulting in the discharge of all indebtedness, ran throughout the convention.

At the closing session R. L. Fitzgerald, Duluth Steam Corp., Duluth, Minn., was elected president for the coming year. Elected and installed also were M. D. Engle, Boston, as first vice-president, T. E. Purcell, Pittsburgh, as second vice-president, and J. R. McCausland, Philadelphia Electric Company, as third vice-president. The executive committee elected consists of the retiring president W. J. Baldwin, Jr., New York, G. D. Winans, Detroit, and Edward Lenz, New York.

Following a morning session on Tuesday devoted largely to opening formalities and routine business, and a get-together luncheon at noon, the afternoon session covered the reports of the rates and regulations and commercial relations committees.

Several papers were devoted to various angles of rates and, significantly enough, turned to questions of policy in connection with demand type rates and their effect. M. C. Huse, Philadelphia, in his paper "A Single Demand Rate for All Customers" explained the type of demand rate in use in Philadelphia. J. W. Wattles, Boston, discussed the selling of demand type rates against off-peak summer rates, and J. H. Walker, Detroit, raised the questions as to whether existing customer regulations are too strict and whether the steam company can afford and justify paying the cost of customer connections as an aid in securing new business. In the lively discussion which followed it was apparent that while there were varying opinions as to how the objective of securing new customers was to be reached, all were in agreement that securing the load on existing lines justifies a long-term view of the return to be obtained.

A satisfactory method of computing steam usage for buildings is a subject to which attention has been turned for some years. In spite of many proposals no standard method of calculation has ever been worked out. G. W. Tuttle, Detroit, described most recent findings and outlined a proposal looking toward a standard method. R. Y. Sigworth presented findings resulting from the operation of buildings on

NEW OFFICERS OF THE NATIONAL DISTRICT HEATING ASSOCIATION
(Upper center) Robert L. Fitzgerald, president; (left) Melvin D. Engle, first vice-president; (bottom center) T. E. Purcell, second vice-president; (right) J. R. McCausland, third vice-president

Members and guests of the NDHA at the annual golf tournament at the Aronomink Country Club

the campus of Pennsylvania State College.

In the evening the subject of hot water heating received attention. A. Margolis, Hamburg, Germany, had outlined his ideas on the present and future of practice using this medium. He felt that steam accumulators should receive more attention and registered his disagreement with the methods used both here and in Russia.

Corrosion has received attention from committees of the association for years. The presentation made by Thomas J. Finnigan, New York, setting forth his findings as part of a program of fundamental research by the New York Steam Corporation was of especial interest. He felt that the findings to date justify the statement that oxygen is about twenty times as corrosive as is carbon dioxide.

On Wednesday morning after listening to a guest speaker—Prof. Herbert W. Heff, of the Wharton School, University of Pennsylvania — plea for a more scientific attitude toward problems of marketing and distribution, the convention followed the reports of the research and sales development committees.

Cell concrete has been applied to underground conduit as an insulator and R. M. Mullen, Pittsburgh, in his paper "Cell Concrete for Underground Steam Line Insulation" discussed its usefulness.

Steam jet refrigeration offers a promising use for summer steam. While a number of installations have been made there have been virtually no test data in existence whereby to judge performance of this equipment or to check the steam consumptions required with it. A. R. Mumford and Ralph Menke, New York, presented data showing that recent installations have shown better economy than did the early ones. They also showed logical lines of attack in approaching the problem of securing additional economies in operation. A resume of their paper appears elsewhere in this issue. R. D. Martin, New York, stated that tests of steam jet equipment in New York had showed the following consumptions per ton per hour: (1) A 180-ton installation showed 34.3, 43.3, and 37.2 lb. in three different tests; a 300-ton installation in a commercial building showed 28.1 and 27.3 lb. in two tests; a 180-ton job in a bank showed 36.9 lb. in one test. He also stated that there are 13 steam jet jobs on the lines of the New York company and that their total capacity is about 1500 tons refrigerating effect. He also reported on one 200-ton job where it was found that the steam jet was more economical than a centrifugal steam machine. He believed that steam jet refrigeration for summer had helped in private plant competition in some instances.

At the Thursday morning session the steam station engineering and the distribution committees presented their papers. Three papers dealt with the various methods and devices available for scrubbing or cleaning flue gases to eliminate solids. "Zeolites" were discussed by L. F. Collins, Detroit, while Harold Farmer, Philadelphia, described methods of caring for boilers which are out of service for extended periods. Seven companies had collaborated in preparing a symposium on various distribution problems. Discussions were lively and occupied the full session.

Meters and metering problems are always of interest because of the necessity of using every possible precaution to ensure accurate metering. On Friday morning the meters and accessories committee took up most of the session with its several papers. W. W. Stevenson, Pittsburgh, described at length a testing installation for turbine type flow meters which uses the radiators in the building as air cooled condensers. The testing station is in the basement. The plant is so arranged that the steam quantities are measured both by a flow meter and by a condensation meter.

Following election and installation of officers and adoption of resolutions the convention closed.

Exhibitors whose products were on display at the convention included American District Steam Co., E. B. Badger & Sons Co., Bailey Meter Co., Bristol Co., Foster Engineering Co., General Electric Co., Keasbey & Mattison Co., Midwest Piping & Supply Co., Minneapolis-Honeywell Regulator Co., National Tube Co., Ric-wiL Co., Schade Valve Manufacturing Co., Taylor Instrument Co., Warren Webster & Co., Yarnall-Waring Co., Schutte Koerting Co., H. Belfield Co., and James P. Marsh Corp.

Million Dollar Air Conditioning Modernizing Contract

(Concluded from page 29)

stalled in the attic and third floor of the Executive Mansion at Washington, by the Central Armature Works, Inc., Washington, D. C., the low bidder on the project, according to the bids opened on June 12. The nearest competing bid was that of the Loughborough Oil Company, whose figure was $5,463. The award was made on a bid figure of $5,280.

Bids which were opened on June 10 were advertised by the National Park Service, Department of the Interior, covering the installation of a ventilating system for the basement of 45 Broadway, New York. Low bidders included: Electric Ventilating and Engineering Co., Inc., 30 Church St., New York, $1,240; B. Z. Construction Co., New York, $1,343, and Raisler Heating Co., New York, $1,847. The contract has been awarded to the Electric Ventilating and Engineering Co., Inc., at the figure bid of $1,240.

A contract to install a ventilating system for the third floor of the first and second wings of the Munitions Building, Washington, has been awarded by the National Park Service to the Central Armature Works, Inc., at a figure of $15,965. The low bidders on this job were: Central Armature Works, $21,665; Loughborough Oil Company, $24,500; American Sheet Metal Corp., Norfolk, Va., $26,734, and Mehrig and Hanson, $27,800. All bids were submitted with a base bid and certain alternate bid proposals.

The U. S. Marine Corps, Navy Building, Washington, advertised for bids to be opened June 17 covering schedule 795 for furnishing and completely installing new gas fired, hot water boilers in 17 public quarters at the Marine Barracks, Quantico, Va. The low bidder was the Virginia Gas Distributing Corp., Staunton, Va., whose bid was $4,557.73.

Steam Jet Refrigeration Operating Results Suggest Methods for Further Economy

CONTINUED improvements in performance with decreased steam consumption, and encouraging prospects for still further economies through improved control of steam jet refrigeration equipment were features of a recent paper[1] based on test results and in which A. R. Mumford and Ralph Menke, authors, discussed operating results obtained as part of a program of data collection undertaken by the New York Steam Corporation for the benefit of its customers. Since the whole program was too extensive to complete in one cooling season only partial results were presented.

Curves (Figs. 1 and 2) show clearly that steam consumption per ton of refrigeration produced decreases as the capacity approaches the designed capacity of the jets in service whether the machine is operated in several stages or in one stage. Control of capacity in the early installations was obtained by increasing or decreasing the number of jets in service, and to an intermediate degree by changing the quantity of chilled water circulating.

Test results show too that the steam consumption decreases with increase of chilled water temperature. The authors ascribe this to the increase of the density of the vapors pumped by the jets as the pressure in the flash tank increases with the rise in temperature of the chilled water.

One chart (Fig. 3) shows how steam consumption of installations accepted during the past few years have shown improved economy of steam consumption as the development of this kind of equipment has progressed.

The authors regard the test results already at hand as offering two methods of attack whereby still further reductions in steam consumption may be brought about.

One suggestion is that economy may be gained by reducing the initial steam pressure of the jets as the capacity of the machine falls off, provided automatic means can be found for accomplishing the reduction.

A second suggestion is that since steam consumption decreases with increases of chilled water temperature, economy can be gained by use of a control method which would keep the chilled water temperature at the highest practical point at all times.

In discussing the effects of the second suggestion the authors note that a change of the range of booster or jet operation from chilled water temperatures of 45° to 47.5° to one of from 47.5° to 50° would be expected to reduce the steam consumption of the jets from about 30 lb. to about 26.5 lb. per ton of refrigeration produced. Such a saving is a substantial percentage.

Two methods of accomplishing this are outlined and illustrated in Fig. 4. Method 1 can be used where maintenance of a steady dewpoint of 50° at the dehumidifier is not essential while method 2 can be used where a steady dewpoint temperature at the dehumidifier is required.

The authors outline their suggestion regarding these two methods in the following way.

Method 1. "If it is unessential to maintain a steady dewpoint of 50° at the dehumidifier, a simple improvement would be to place the thermostat of the automatic booster in the return chilled water line and maintain the temperature of the returns at 50° (see Fig. 4). With this arrangement the machine would refrigerate from 50° down to a temperature which would take care of the existing load, at a maximum water flow. A certain amount of lag is inherent in this method, due to the time required for a changed refrigeration to affect the temperature of the return. This lag is practically equal to the time required for a full change of water in the flash tank. A fluctuation in return water temperature of a degree or two is to be expected, which in turn would change the dehumidifier outlet dewpoint a like amount."

Method 2. "When the control of the air condition is so designed as to require an unvarying dewpoint the

[1] "Operating Economies Reached by Control of Steam Jet Refrigeration," before the 26th annual convention of the National District Heating Association, Philadelphia, June 12, 1935.

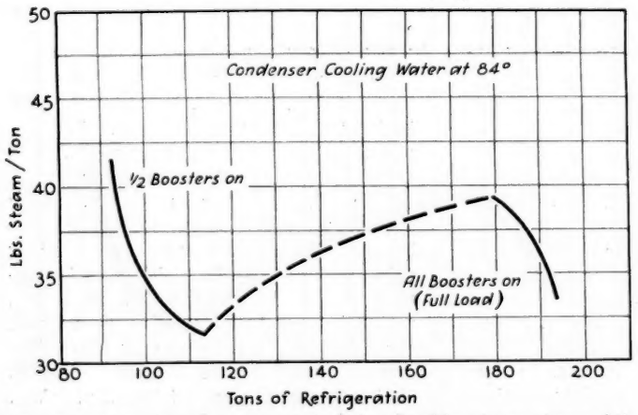


Fig. 1. Unit steam consumption for double stage steam jet.

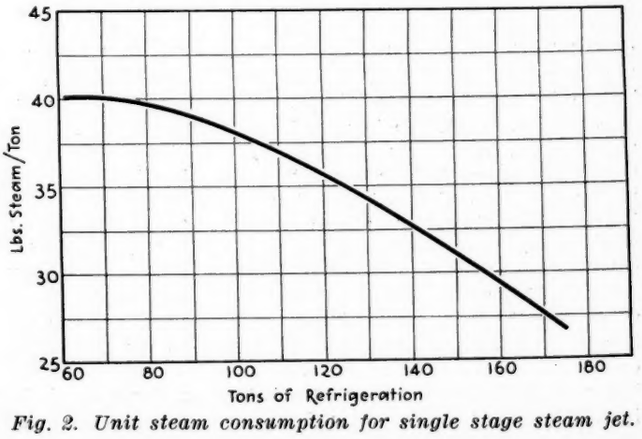


Fig. 2. Unit steam consumption for single stage steam jet.

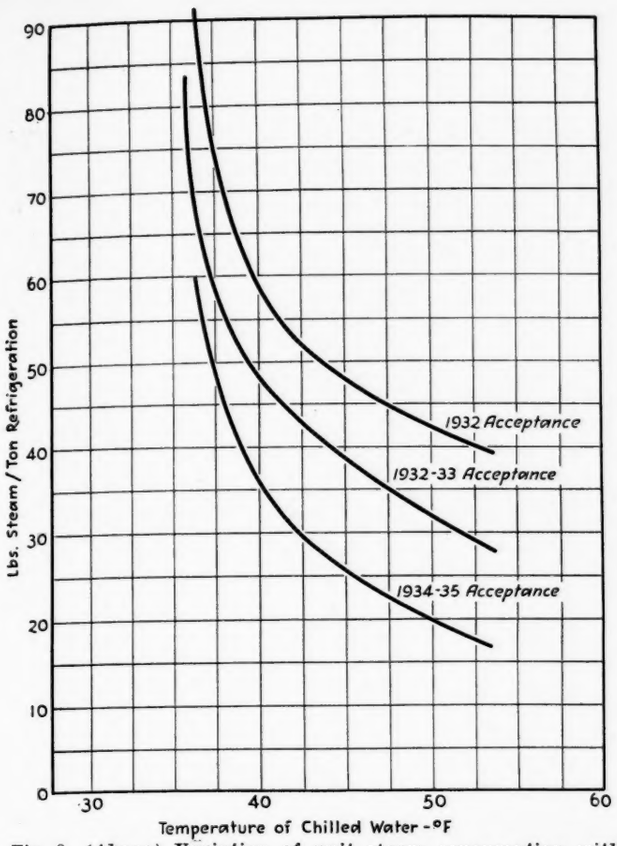
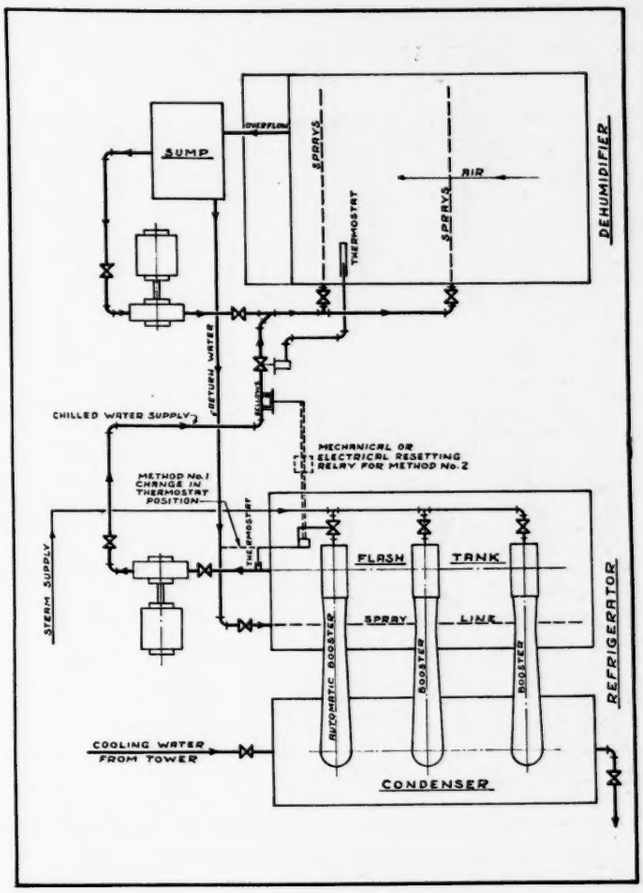


Fig. 3. (Above) Variation of unit steam consumption with temperature of chilled water. The curve also shows the improvement in steam consumption made in the last three years. Fig. 4. (Right) Two methods of control for changing the chilled water flow and temperature.



lag introduced by the simple change of thermostat position can be eliminated by causing the tendency of the pressure in the discharge line from the chilled water circulating line to rise as the flow is slightly restricted to act as a secondary control of the automatic booster. Thus if the refrigeration load drops off in the dehumidifier, the chilled water flow would be throttled and tend to decrease. If a pressure sensitive device were installed in this line and so connected that it would operate the automatic booster, the response of the jets to the demand for more chilled water would be without appreciable lag. The change in temperature of the chilled water caused by the cutting in or out of the automatic booster would remove the cause of the tendency to change the flow of chilled water and result in a practically constant rate of flow."

Discussing possible economies in consumption to be gained by varying the initial steam pressure as the load changes the authors draw attention to the fact that since the load factor of the cooling load is only about 60% for the season, a considerable reduction in annual steam consumption can be obtained if advantage can be taken of the higher flash tank temperatures which would

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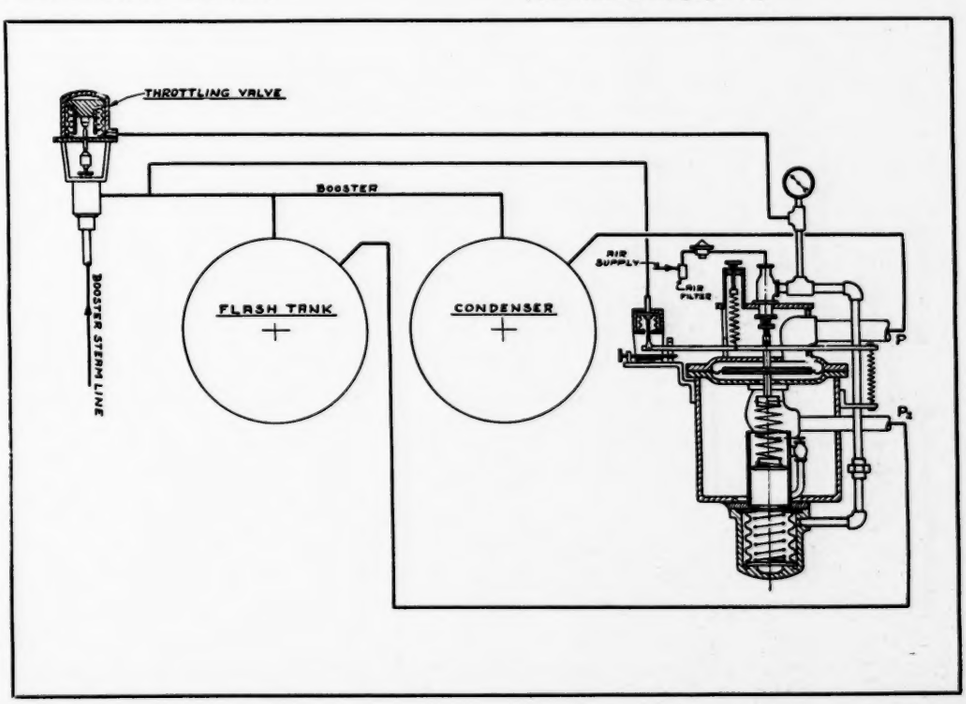
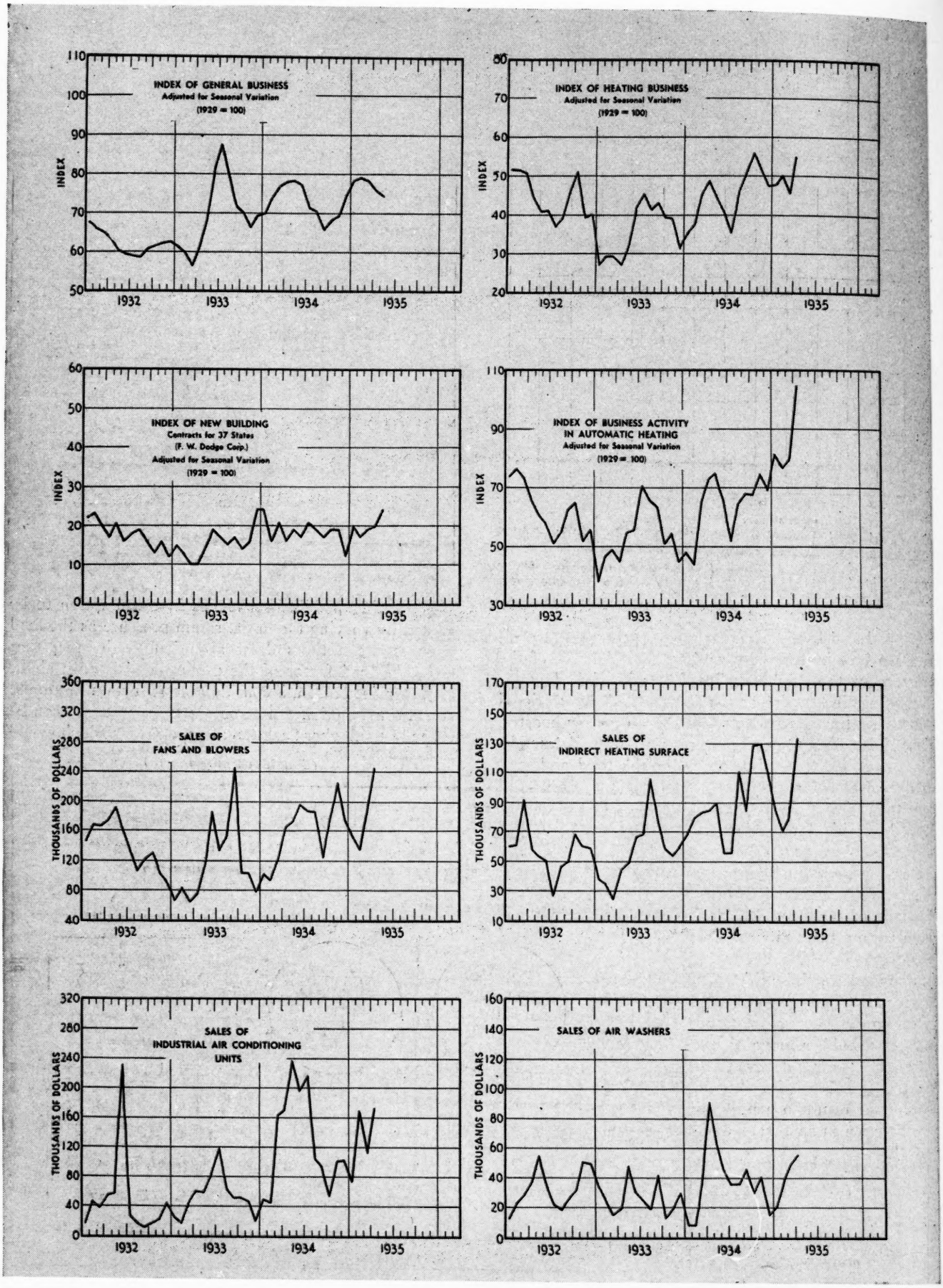


Fig. 5. A method of controlling the differential in steam pressure.

BUSINESS TRENDS



Residential Building Up, Indexes Increase Substantially,

reflecting encouraging increases in heating and air conditioning businesses

THE business outlook for the construction industry and its branches continues to be more and more encouraging. May building figures as reported by F. W. Dodge Corporation covering the first five months of 1935 show that contracts for residential buildings were $158 million, the highest first five months of any year since 1931. Although general business continued a slight decline during May, HEATING AND VENTILATING's seasonally adjusted Index of Heating Business rose from 45.6 in March to 54.4 in April. The increase was largely the result of a sharp rise in oil burner installations which also caused an extremely large increase in the Index of Business Activity in Automatic Heating, bringing the index up to 1929 level.

Table 3 shows the trend of equipment sales in the industry, and also the trend of this publication's indexes.

Building

Figures on residential contracts let during the first five months of 1935 indicate an increase of 50% over the corresponding period of last year. This brings the total contracts let on a level with the corresponding period in 1932. A breakdown of the figures is given in Table 1 showing the percentages (in per cent of total residential) of last year and this year.

These figures show the difference in activity this year as against last year.

TABLE 1

	1934	1935
Apartments	14.5%	20%
Dormitories	12%	4%
Hotels	2%	2.1%
Housing developments	11.5%	14.75%
Total	40.0%	40.85%
Other residential	60.0%	59.15%
All residential	100%	100%

Apartment houses increased greatly, dormitories fell off, hotels remained about the same, and housing developments increased moderately.

Building Costs

The New York Building Congress, in a study of the average cost of constructing large urban-type buildings in the Metropolitan area, reports that these costs are down 15% from the 1928-1929 levels. Cost indexes for different types of buildings as compared with the earlier levels are given in Table 2.

At the time these data were received, the reduction in other cost indexes from 1929 were as follows: general wholesale commodity prices were 17½% less, farm prices were 20% less, and the cost of living was 18½% less. In the weeks that have elapsed since these comparisons were made, there has undoubtedly been a rise in these other indexes, so that today it is probably correct to state that the decline in building costs compares favorably with the decline in other cost indexes.

The Congress concludes from its studies that Metropolitan building costs, at the present time, do not constitute a major cause of the current low volume of construction activity in New York, the principal cause being the severe decline in the returns on improved real estate brought about by reduction in rental scales of practically all classes of property.

TABLE 2

	1928-1929	1934
1. 16-story apartment building (mid-Manhattan)	100	86.4
2. 2-story and basement school, Long Island	100	75.0
3. Commercial loft—25 stories	100	88.0
4. Highly finished Hospital Bldg., reinforced concrete frame, brick veneer, 15 miles of New York	100	87.1
5. Office building—58 stories	100	85.0
6. Fireproof office building, 12 stories	100	85.0
7. Non-fireproof store and office building, 2 stories	100	86.0
8. 1-2-3-4 room apartment building	100	86.8
9. Reinforced concrete warehouse and freight terminal—12 stories	100	85.7
		85.0

TABLE 3

EQUIPMENT	APRIL, 1935	APRIL, 1934	MARCH, 1935
Oil burners, number of units shipped in United States	6,873	5,106	4,282
Boiler-burner units, shipped in United States	613	400	361
Ventilating blowers, orders in dollars	112,226	91,952	73,023
Small housed blowers, orders in dollars	43,425	94,229	49,289
Air washers, orders in dollars	56,009	91,275	49,251
Industrial air conditioning units, orders in dollars	173,464	169,971	114,626
Industrial unit heaters, orders in dollars	185,869	157,681	180,592
Schoolroom unit ventilators, orders in dollars	138,362	75,357	109,051
Non-ferrous indirect heating surface, orders in dollars	127,638	64,202	74,866
Cast iron indirect heating surface, orders in dollars	3,670	11,819	1,411
Residential stokers, sales, number of units	955	433	1,113
Steel boilers, orders square feet of heating surface	75,171	54,440	55,611
Cast iron round boilers, shipments in thousands of pounds	2,115	2,544	2,102
Square cast iron boilers, shipments in thousands of pounds	7,730	8,287	6,964
Cast iron radiators, shipments in thousands of square feet	2,366	2,682	2,023
Non-ferrous convectors, sales, elements only, square feet	46,182	30,030	48,013
Non-ferrous convectors, sales, with cabinets, square feet	106,488	135,164	87,225
Cast iron convectors, sales, square feet	137,854	86,655	142,465
INDEXES (1929 = 100), SEASONALLY ADJUSTED			
Heating Business	54.4	48.8	45.6
Automatic Heating Business	104.3	73.0	79.4
Heating Contractor Activity	36.3	37.7	34.5
	MAY, 1935	MAY, 1934	APRIL, 1935
New Building Contracts	24.0	19.0	20.0
Stock Prices (11 typical companies) (unadjusted)	35.5	26.1	31.7

Tests on an Industrial Unit Heater

result in a performance chart and suggested changes in test code

By R. D. FELLOWS† and F. C. STEWART‡

DURING the past few years, blast type heaters made in small sizes, and called unit heaters, have been applied to a wide variety of uses. Upon the application of these smaller units to different types of heating and cooling, there was a demand for specifications for making tests on this type of unit, and also for information regarding ratings and operating characteristics. In order to satisfy some of the demands, the A.S.H.V.E. and the Industrial Unit Heater Association adopted a test code for making these tests. This code was published in April, 1930. Shortly after this, the Mechanical Engineering Laboratory of The Pennsylvania State College became interested in a study of the operation of unit heaters and an investigation was undertaken which had four objectives: First—to determine the workability of the adopted test code; second—to develop a technique for testing unit heaters; third—to determine operating characteristics of a unit heater operating on saturated steam; fourth—to investigate the effect of superheated steam on its performance.

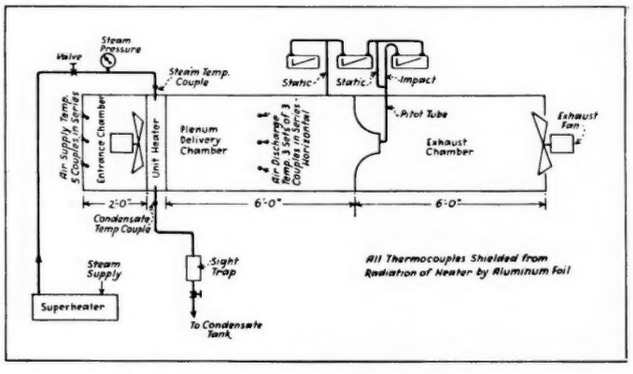


Fig. 1. Arrangement of apparatus for testing unit heaters.

The first two of these objectives are interrelated, for in order to determine the workability of the methods of making a test, the technique for making such a test must, of necessity, be developed, and, therefore, the first two of these objectives will be discussed together.

Before proceeding with the construction of the test apparatus, the unit heater to be investigated had to be selected. The heater decided upon had the following specifications: it was made up of 92 pitched, horizontal, ⅜-in. copper tubes, placed 23 high and 4 rows deep, and staggered; copper fins, ⅞ in. square and six to the inch, placed on the outside of the tubes; overall frontal dimensions of the heating element, 21¾ in. wide and 23 in. high, giving a frontal area of 3.47 sq. ft.; net area through the space between the tubes of each row, 1.97 sq. ft.; total heat transfer area on the air side, 123.14 sq. ft., and on the steam side 13.58 sq. ft., giving a ratio, "R", air side to steam side area of 9.08. In order to insure good contact between the fins and the tubes, the entire tube bank had been dipped in a tinning bath.

A four-bladed fan, 18¾ in. in diameter and driven by a ¼-hp. d.c. motor operated on 110 volts at 1150 r.p.m. supplied the air to the heater. Specifications indicated that the fan would deliver about 2400 c.f.m. of air and the heater had a heat delivery of 180,000 B.t.u. per hr. From this information, the test apparatus was built conforming with the unit heater test code.

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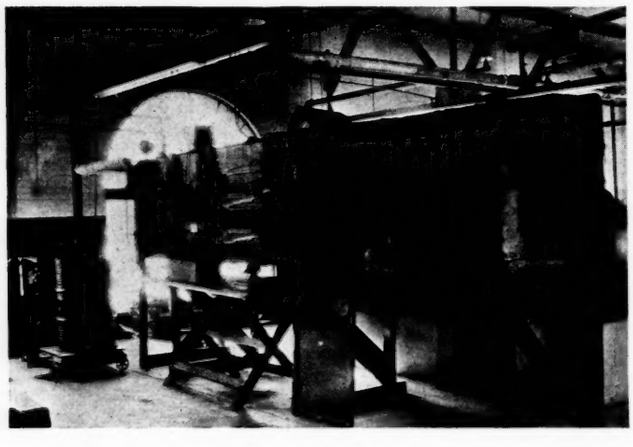


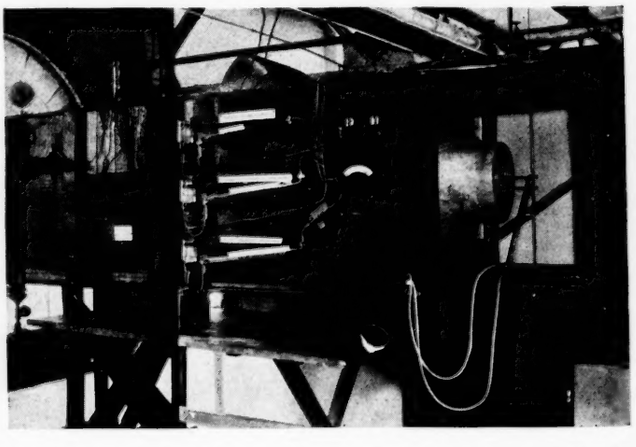
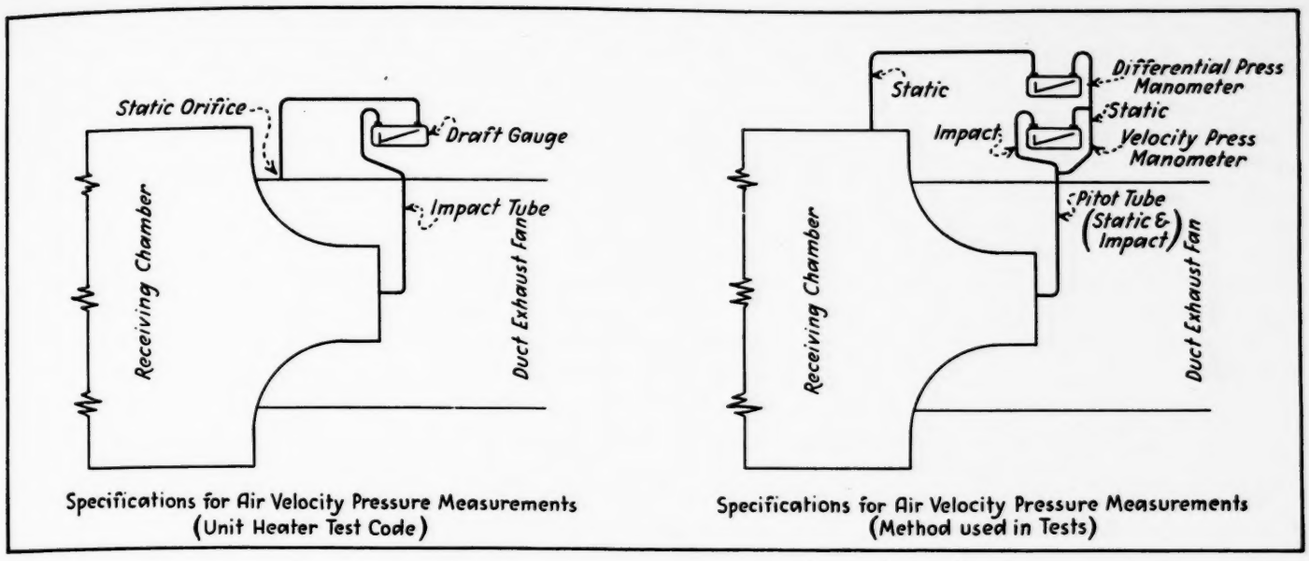


Fig. 2. (Left) Unit heater test apparatus as set up in laboratory. Exhaust chamber and fan at right. Fig. 3. (Right) Instrument panel and discharge nozzle of plenum chamber.



Figs. 4 and 5. Arrangement of instruments for making air velocity pressure measurements (left) as suggested by the code and (right) as used in tests.

The code requires a heater to be set up in a chamber and suggests that the air shall first pass through the entrance chamber to the heater and then be delivered into the plenum delivery chamber, then drawn through the bell mouthed orifice to an exhaust chamber and fan. This general arrangement was followed as indicated by the schematic diagram shown in Fig. 1. The specifications of the code on the size of the plenum chamber were such as to require 20 to 90 changes of air per minute. The chamber then required for this heater would be one with a volume of 28.9 cu. ft. to 116.7 cu. ft. After giving consideration to the structural details and the scope of the tests to be run, it was decided to build the chamber to fit the outside dimensions of the heater, which were 30 in. wide and 32 in. high, and to make the chamber a little over 6 ft. in length.

For measuring the air, the orifice was placed at the opposite end of the plenum chamber from the heater so as to discharge into the exhaust chamber, which was evacuated by means of an exhaust fan. The object of the exhaust fan is to draw the air through the orifice for measurement and to maintain atmospheric pressure in the plenum chamber. Photographs of the final set-up are shown in Figs. 2 and 3.

The walls of the chamber consisted of one 7/8-in. thickness of tongue and groove boards, one thickness of 1/4-in. beaver board, then another layer of 7/8-in. tongue and groove boards. This gave a total wall thickness of a little over 2 in., which seemed ample to prevent any serious heat loss during the test.

The nozzle for measuring the air was built according to the overall dimensions specified in the code. In order to handle the air indicated, a nozzle having a discharge diameter of 10 9/16 in. was required. The orifice was made of patching plaster which was cast over a wooden core having a logarithmic flare. The core was turned out of pine and coated with paste wax. The wall thickness of the plaster nozzle was about 1 in. After smoothing the inside of the nozzle with steel wool and sandpaper, the nozzle was shellacked to prevent absorption of moisture.

It was found that the calorimeter readings for the steam supplied were not sufficiently reliable to give the correct quality of the steam entering the unit heater. For that reason superheated steam was used and a gas-fired superheater was constructed capable of supplying steam with 125° of superheat.

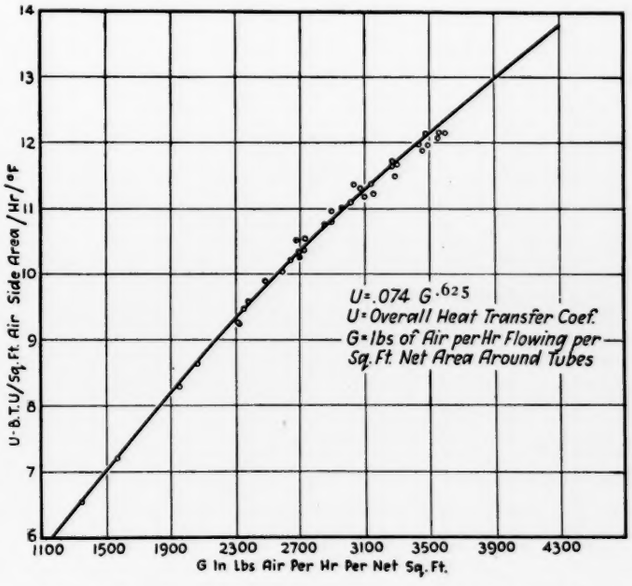


Fig. 6. Effect of increased air flow on the heat transfer coefficient of a unit heater.

Temperature readings were taken by means of thermocouples. There were five couples in series for measuring the temperature of the intake air. These were placed in the form of a dice-five across the intake end of the entrance chamber in a plane perpendicular to the line of flow. The temperature of the air delivered from the heater in the plenum chamber was taken at a distance of about 3 ft. from the heater. In order to determine if there was any stratification of air, three sets of couples each having three couples in series, were strung hori-

zontally across the line of flow, ¼, ½, and ¾ of the height of the plenum chamber. The arrangement of the intake and discharge air couples is shown in Fig. 1. Couples were of copper constantan wires and readings were taken by means of a potentiometer. All of the air measuring couples were shielded against radiation by means of aluminum foil. The steam temperature was taken by means of a cromel-alumel couple placed in the steam main next to the heater. Air humidity was determined by wet and dry bulb thermometers placed in the draft of the intake air.

Air was taken from the exhaust chamber by a four-bladed, 17¾-in. diameter fan, driven by a ¼-hp., 1725-r.p.m., 110-volt, d.c. motor. Both the heater fan and the discharge fan were equipped with rheostats to facilitate variable speed operation.

Manometers for measuring the air pressures were so placed that a change of 10 in. on the manometer tube indicated a change of 1 in. of water vertically. In order to prevent sluggishness of operation, a few drops of liquid soap were placed in the manometer water. Three manometers were used; one for measuring the static pressure in the plenum chamber, one for differential pressure across the orifice, and one used on the Pitot tube.

In order to obtain some idea of the variation in the flow of air through the heater, 10 thermocouples were placed on a radius between the center of the heater and the outer edge on the delivery side. These couples indicated a maximum variation in temperature of 5°, indicating that the variation in the mass flow of air was no greater than 2.8%.

The first series of tests conducted was made to determine the accuracy of observations and to develop

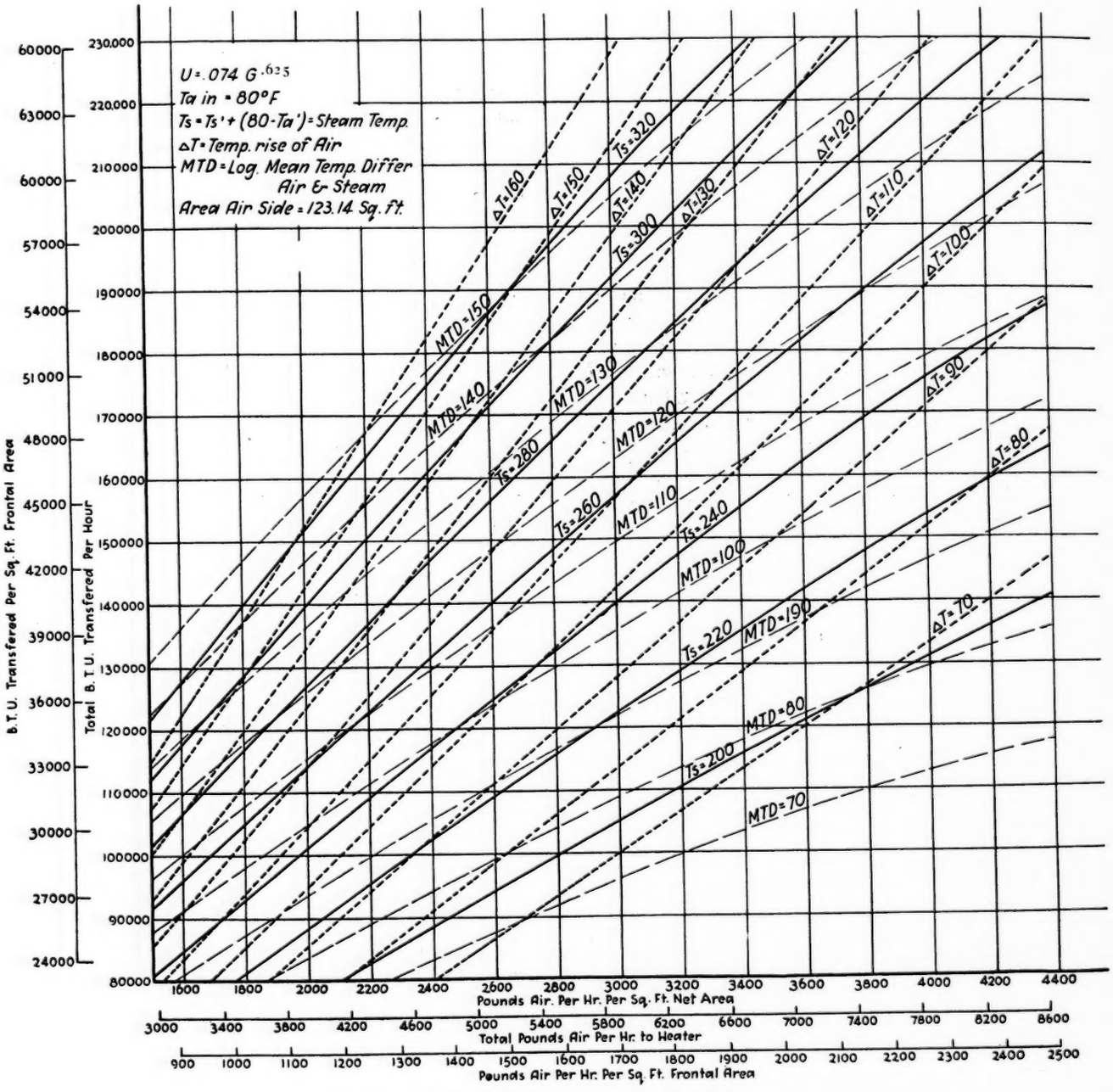

U = .074 G^.625
Ta in = 80°F
Ts = Ts' + (80-Ta') = Steam Temp.
ΔT = Temp. rise of Air
MTD = Log. Mean Temp. Differ Air & Steam
Area Air Side = 123.14 Sq. Ft.
B.T.U. Transfered Per Sq. Ft. Frontal Area
Total B.T.U. Transfered Per Hour
Pounds Air. Per Hr. Per Sq. Ft. Net Area
Total Pounds Air Per Hr. to Heater
Pounds Air Per Hr. Per Sq. Ft. Frontal Area

Fig. 7. Performance characteristics of unit heater.

a technique in the manipulation of the apparatus. If the observations taken were correct, the calculated results should give a balance between the heat given up by the steam and the heat absorbed by the air. The results obtained from the observations taken according to the code set-up, shown in Fig. 4, indicated the heat absorbed by the air to be 6 to 7% higher than the heat given up by the steam. An investigation was made of the air measurements and it was found that the measurements taken according to the test code were in error due to the fact that no specifications were given as to the type of exhaust fan to be used or the method of making the connection of the fan duct to the discharge side of the nozzle. It was found that with the propeller type fan used, a great difference in the static pressure between the center of the fan and at the tip of the blades on the suction side existed. Hence, by taking the static pressure according to the code, which is at the periphery of the exhaust chamber and back of the discharge side of the nozzle, greatly reduced static pressures were observed. This static pressure used in conjunction with the Pitot tube, as described, gave quantities of air in excess of the amount actually flowing. The coefficient of discharge of the nozzle, as determined by this method, came out to be about 0.94, which is lower than the 0.99 recommended by the test code.

When this discrepancy was discovered, Pitot tube traverses of the nozzle were taken and the true amount of air circulated was calculated by using the velocity and the static pressures at the points of observation and the area of nozzle affected. The air as determined by the Pitot tube was compared to the air calculated, using the pressure differential as shown by Fig. 5. The coefficient of discharge for the differential pressure came out to be 1.01. This high coefficient was due to the velocity of approach which was neglected when using the differential pressure.

During the test runs, the exhaust chamber was lengthened to over 6 ft. to minimize the uneven static pressure distribution. Heat balances were then obtained which checked within 2%, the steam always showing higher quantities of heat transferred than the air. The heat absorbed by the air as calculated was used as the basis for the results here presented.

The general operation of the apparatus as prescribed by the code proved to be workable and adaptable to most types of tests; the only difficulties encountered were those prescribing the air measurements and the lack of exact specifications regarding the type and location of the exhauster fan.

After building the apparatus in such form and developing the technique to such an extent that accurate results could be obtained, an investigation was made of the operating characteristics of the unit heater previously described. Operating characteristics mean the effect of the variation in steam temperature, the quantity of air flowing through the heater, the temperature of the air supplied to the heater, the mean temperature difference and the rise in temperature of the air on the heat delivery. All of these variables were investigated in the following manner. Tests were organized in a series of runs in which the steam temperatures were held constant and the quantity of air supplied to the heater varied; which in turn varied the temperature rise and mean temperature difference. From observations made, the overall heat transfer coefficient, based on the logarithmic mean temperature difference, the air side heat transfer area, and the saturated steam temperature were calculated; also the weight of air flowing in pounds per hour, pounds per square foot of frontal area, and pounds per hour per square foot of net area, "G", were determined.

The heat transfer coefficient was then plotted as ordinate and the weight of air per square foot of net area, "G", for each of the constant steam temperatures as abscissa. It was found that the points formed a belt having a width equal to 1½% of the mean curve drawn through the points as shown in Fig. 6. The equation of this curve is

$$U = .074\ G^{.625}$$

where U is the overall coefficient based on the air side area and G is pounds of air flowing per hour per square foot of net area around the tubes. This equation is of the same type as

$$U = \frac{C \times G^n}{D^{1-n}}$$

where D is the diameter of the tubes in feet, C is a constant, and n is a constant depending upon the type and arrangement of surfaces.

A discussion of this type of equation for various applications may be found in "Industrial Heat Transfer" by Shack, and "Heat Transmission" by McAdams. The investigation carried on at The Pennsylvania State College was not intended to study the effect of tube diameter, hence the equation, $U = .074\ G^{.625}$ does not include this item.

The coefficient of heat transfer plotted against the logarithmic mean temperature difference showed that for the constant weights of air flowing, the coefficient of heat transfer was independent of the mean temperature difference. With the assistance of these two curves and a summary of the calculated results, the performance characteristic curves of the unit heater were plotted, as shown in Fig. 7. With the total weight of air supplied to the heater as abscissa and the total heat delivered as ordinate, a family of curves was plotted for an entering air temperature of 80°. Constant steam temperature curves, "T_s", were plotted from the observed data. The temperature rise curves "ΔT" and the logarithmic mean temperature "MTD" were also plotted and appear in Fig. 7.

It will be noticed that the values thus far mentioned apply to the heater tested, but these curves may also be made to apply to any heater of this series built on the general dimensions and arrangement of surface of the heater tested, by indicating the weight of air flowing per square foot of frontal area and the heat given up by the heater per square foot of frontal area. These values are indicated on additional scales on the performance curves. Thus a heater 4 × 5 ft. would have total quantities 20 times the values given per square foot of frontal area.

It is interesting to note that the performance curves

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Engineers and Contractors Outline Ideas on Federal Construction,

recommend percentage fee basis for professional service on work-relief jobs, ask for material purchase through contractors

THE Construction League of the United States through its special committee on the federal work-relief program[1] recently formulated a number of suggestions for consideration by department heads and others in administration circles in Washington in order to present what is claimed to be the collective viewpoint of the construction industry. The League's recommendations follow:

Classification

So that the program be productive of useful works, and that waste and inefficiency be eliminated to the greatest possible degree, it is essential that the unemployed drawn from relief rolls should be put to work on projects suited to their capabilities, and at rates of pay established in accordance with the Act.

A practical accurate occupational classification of the persons to be given employment is essential to the success of the program.

To insure the selection of competent workmen for construction projects, those on relief rolls must be classified on the basis of their experience, training, and skill in the several occupations provided. Each person claiming to qualify for employment on construction must be subjected to examination, his employment record investigated, and his competency satisfactorily demonstrated.

Closely related to and dependent upon the occupational classification of the unemployed, is the procedure for placing them in jobs. There should be only one employment service. Duplication of such service will result in confusion, and in placement of incompetents, or the duplication of enrollments.

The work-relief program will be incomplete if it lacks provisions for rehabilitation of the greatest possible number who have broken under the strain of the depression and for the vocational training of the youth of the country who have never had a job. To every construction project there should be an assignment of apprentices based upon a practicable working ratio to the number of skilled mechanics employed.

Design of Projects

Type of Agreements: The professional service of engineering, architectural, and landscape architectural firms should be engaged on a percentage fee basis. But where this procedure is impracticable such services may be engaged on a fee basis which should provide for payment of a *per diem* or weekly fee for principals and for supervisory assistants and an allowance for overhead expenses, together with the actual salaries for relief workers.

The relative competency of the workers must be left to the determination of the professional firm. The agreement should specify, that in cases of faulty classification the firm, subject to certain necessary restriction, should have the right to dismiss those drawn from relief rolls, recommend their reclassification, and draw other workers from the relief rolls in their places. In case no competent men are available on the relief rolls, workers should be obtained as far as possible from the local unemployed.

Regular employes in public agencies and private enterprise should not be replaced by persons drawn from relief rolls, nor should the work customarily performed by such agencies and enterprises be transferred to new agencies created to provide employment for relief workers.

Qualification of Architects and Engineers: Architects and engineers to be thus engaged on a percentage fee basis or on a weekly or daily fee basis should be properly qualified for the specific types of professional services they are to render.

Selection of Architects and Engineers: Selection of architects and engineers to be thus engaged shou'd be done locally through properly constituted architectural and engineering boards whose members should be required to agree to non-participation in the actual work under the program, and who would be compensated on a basis of either actual expenses or time expended or both.

The members of the national and local qualification and selection boards should be appointed by the President from nominations made by the Construction Code Authority.

Construction Contracts

Type of Contracts: All work possible should be executed under lump sum or unit price type of contracts awarded through competitive bidding by contractors. Where management contracts are deemed more feasible, due to certain conditions, a fixed fee should be used and not a fee which is based on a percentage of the cost of the work. The contracts used should provide that the contractor may employ an administrative and supervisory force of his own choosing (limited to a minor percentage of the total employes) and that other employes shall be drawn from the relief rolls when properly qualified men are available on such rolls in accordance with the terms of the Act. The contract should stipulate the wages that must be paid to each class of employe.

The relative competency of the workers and their willingness to work must be left for determination on the job. The contract should specify that in case of faulty classification the contractor, subject to certain necessary restrictions, should have the right to dismiss or transfer the workers, or recommend their reclassification and draw other workers from the relief rolls in their places. In case no competent men are available on the relief rolls, workers should be obtained as far as possible from the local unemployed.

Qualification of Contractors: Contractors and subcontractors on all work should be properly qualified on the basis of the codes for their respective branches of the industry.

Selection of Contractors: Selection of contractors and subcontractors on competitive lump sum or unit price type of bidding is automatic.

With regard to selection of contractors and subcontractors on the management type of contract, this should be done locally through properly constituted industry boards whose members should be required to agree to non-participation in the actual work under the program, and who wou'd be compensated on a basis of either actual expenses or time expended or both.

The members of the national and local qualification and selection boards should be appointed by the President from nominations made by the Construction Code Authority.

Construction Materials

The purchase of construction materials for relief work should be according to normal procedure, namely through the usual distribution channels and by contractors and special contractors. Such a procedure will

(Concluded on page 68)

[1]The committee consists of S. F. Voorhees, chairman, E. J. Harding, George T. Seabury, F. P. Byington, Gordon Marshall, John H. Zink, and B. R. Value, secretary.

MODERNIZING SECTION

FHA Prepares Plans for Campaign on Commercial Modernizing

made possible by the amendment to the Housing Act permitting insurance of loans to $50,000 for business buildings. Home modernizing loans averaging 3/4 million daily

REGULATIONS governing the extension of modernization credit by financial institutions for improvement of properties under the $50,000 provision of the amended National Housing Act "open a new market which should be of direct benefit to practically all industry and of indirect benefit to the nation as a whole," according to Acting Federal Housing Administrator Stewart McDonald.[1]

The heating and ventilating industry is vitally interested in these recently adopted regulations, and an understanding of their provisions is necessary to a complete cooperation with the better housing program.

Particularly pertinent and worthy of the closest study is that portion of the new regulations concerning the class of modernization credit made possible by the $50,000 amendment. This type of credit is extended for additions, alterations, repairs, and improvement for "real property improved by or to be converted into apartment or multiple family houses, hotels, office, business or other commercial buildings, hospitals, orphanages, colleges, schools, or manufacturing or industrial plants." The maximum limit of credit obtainable for each separate property is $50,000.

As we go to press, FHA is working on a booklet designed to aid in the campaign to obtain modernizing business from the class of buildings eligible under the amendment. The book will be titled "Modernizing for Profit." In addition, there will be a book containing questions and answers regarding the type of equipment eligible for loans and other information, similar to that in a previous pamphlet published by FHA for the home modernizing campaign. Plans are being prepared under the direction of FHA's committee of eligibility.

Home Modernizing

In 11 weeks there has been an increase of 100% in the amount of money owners have obtained through the modernization credit plan of the housing act. During the week ending April 1, $2,026,000 was advanced by financial institutions under the modernization credit plan, a daily average of $337,666. Eleven weeks later, June 17, $4,276,000 of credit advances were made, a daily average of $712,666.

[1]The maximum limit of the amount of credit obtainable for the improvement or modernization of individual *homes* and other classes of property mentioned in the original act remains fixed at $2,000. This type of credit is being provided for the purposes of making additions, alterations, repairs, and improvement of real property, including also such new construction as garages and certain other similar structures.

Mutual Mortgages

Most notable is the increase in insurance issued under the mutual mortgage insurance plan of FHA. This increase has been over 300% in 11 weeks. Mortgages submitted to FHA for insurance during the week ending April 1 totaled $2,483,000, a daily average of $413,833. As of the week ending June 15, $7,391,000 of mortgages were submitted for insurance, a daily average of $1,231,833.

While the greater portion of this amount was for refinancing existing mortgages, 33% of the insured mortgages were on new construction.

New FHA Division

Creation of a low cost housing division as a separate unit of FHA has been announced by Acting Administrator Stewart McDonald. The new division will function under the jurisdiction of the deputy administrator for mortgage insurance.

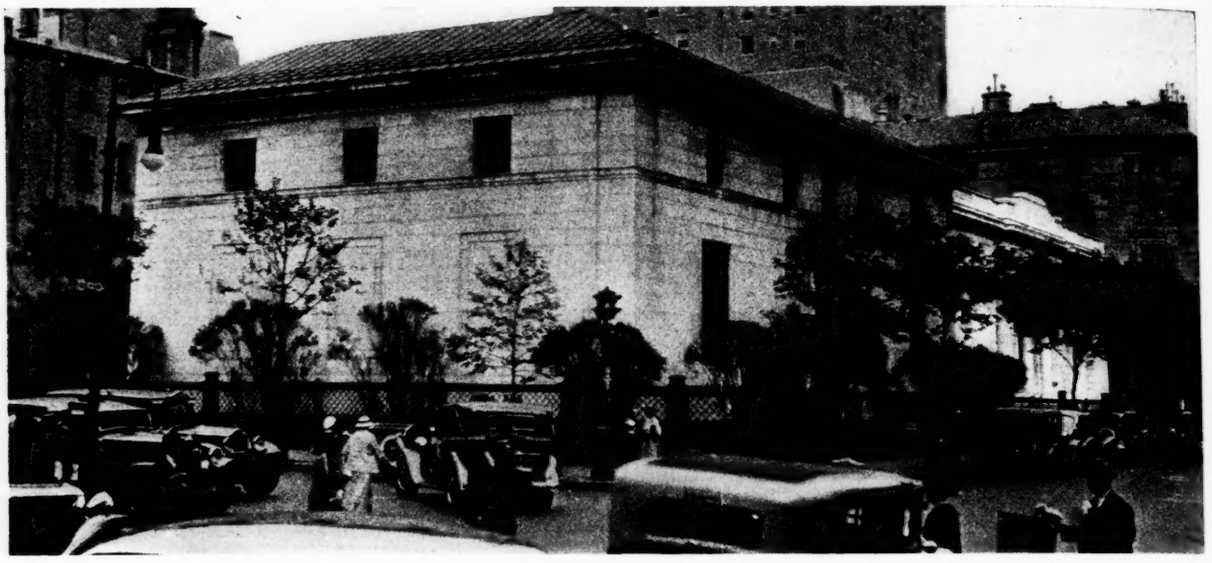
Miles L. Colean has been named director of the new division, and all personnel in other housing administration departments who have been assigned to the various phases of examination of low cost housing projects will in the future be coordinated under his direction.

Construction League Active

Seeking to preserve as many of the benefits obtained under NRA compulsory codes as possible, the Construction League of the United States, as the representative of many leading organizations in the construction field, has undertaken the formation of a Construction Trade Practice Council composed of representatives of all industries concerned with construction.

The purpose of the council, according to Col. John P. Hogan, chairman of the League, will be to formulate a set of fair trade practices and standards for the industries. Action authorizing its formation was taken at a meeting of the general assembly of the League at the Willard Hotel in Washington June 10, called at the instance of the American Institute of Architects and the Producers' Council, two member groups.

The fair trade practices and standards to be drawn will be intended, Colonel Hogan said, to provide a broad general basis by which the construction industries can act in coordination for the betterment of conditions within the industries.



Morgan Art Museum and Library which has an air conditioning system to preserve its books and art treasures

Air Conditioning Modernizes Museum, Prevents Deterioration of Art Treasures

LIBRARIES and art museums built during the last few years have, for the most part, been equipped with modern heating and air conditioning equipment for the maintenance of proper temperature and humidity conditions necessary for the preservation of the book bindings, paintings, tapestries, and other valuable objects stored in these buildings. However, there are numerous such structures throughout the country built many years ago and without modern equipment which are a market for modernizing by alert contractors and engineers.

A fine but relatively little known art museum and library owned by J. Pierpont Morgan and located on East 36th Street in New York, recently underwent a modernizing changeover. The old, original building of the group of two is about twenty years old. The rare first editions, the priceless tapestries and other works of art last year were found to be drying up, parting at their seams, and disintegrating beyond ability to repair through the absence of sufficient moisture in the air. Coupled with undue dryness, the air supply admitted considerable street dust, which proved still another disintegrating factor. Both deficiencies were remedied through modernization effected by T. F. Hall, Inc., Long Island City, N. Y., contractor, and Meyer, Strong & Jones, New York, engineers.

The old heating and ventilating system was of the indirect type with small heater stacks, supplied by district steam, placed at the bases of several air stacks. To prevent the infiltration of street dust each exterior opening to the stacks had cheesecloth filters. In summer the system was not so subject to criticism as in winter, although the filtering cloth had to be cleaned almost daily and frequently renewed. In winter, on the other hand, raising of air temperature without the introduction of moisture resulted in extreme dryness in the rooms.

The engineers specified the addition of a large centrifugal fan, an air washer, a submerged type of water heater to heat the washer water as required, automatic control and replacement of the old filters by new, dry sectional filters. The old heater stacks at the bases of air supply ducts were removed because they are not now required. The washer water is chemically treated to prevent corrosion.

Outdoor air passes through the filters, then through a primary heater, to an air washer. Clean, humidified air flows through a final heater for delivery to the duct system to the upstairs rooms. An outdoor thermostat turns on the primary heater at 32° outside temperature. Washer water, whose temperature is automatically controlled to maintain 50% relative humidity in upstairs rooms, is governed by a room humidistat. This instrument regulates the water temperature by controlling the steam supply to the submerged water heater.

The room thermostat controls the operation of the reheater, opening as required a bypass damper beneath the heater section as well as turning steam on or off to the heater sections. Thus the room temperature is maintained at 70° and 50% relative humidity throughout the heating season. The ventilating fan handles 8,250 c.f.m. and is driven by a 5-hp. motor by rope drive.

Reducing Operating Costs by Changes in Mechanical Equipment

By G. KENDRICK BRINGHURST†

The author here describes an example of a hotel and two loft buildings for which the fuel consumptions were reduced by rearrangement of radiators or piping with relatively small investment in equipment

ALTHOUGH the amount of savings may appear small in some of the examples of modernizing described in this article and those to follow, it must be realized that during periods of low rentals, low percentages of occupancy and delinquent rents, the opportunity to effect any saving, however small, should not be overlooked.

It appears that mechanical plant changes during the present period are generally made for either one of two reasons: to provide heating, ventilation, or other like service necessary to retain tenants, or to reduce operating costs in such manner that the cost of the changes will be paid for in the savings of one, two, or three years' time.

During pre-depression years, there were undoubtedly high pressure engineers who sold their services through optimistic estimates of savings, and sometimes got away with it. If after the recommended changes were made, the savings did not approach the engineer's estimate, and the engineer was dropped by that particular client then, through his ability to sell his services, the engineer would acquire other clients. There were plenty of owners who could be convinced in those days.

The successful engineer of today, however, is the one who retains his clients, counting on their future work and on their recommendations to others to keep his office active. Even though he is most conservative in his estimates, this engineer will find that some owners, perhaps due to past experience, will discount the engineer's estimates by 10 or 15%. Therefore, if the engineer takes off 15% to be conservative, and the owner takes off another 15% to protect himself, although the actual return might be say 40%, the return apparent to the owner would be less than 30%, which explains why a number of healthy prospects are still in the pending stage.

For the best interests of all concerned, the engineer should therefore determine, if possible, the type of business men with whom he is dealing, before submitting his final estimates.

The following cases are among those which illustrate the means by which reduced operating costs resulted from changes in equipment and operation in several commercial type buildings and residences.

†Consulting Engineer, Philadelphia.

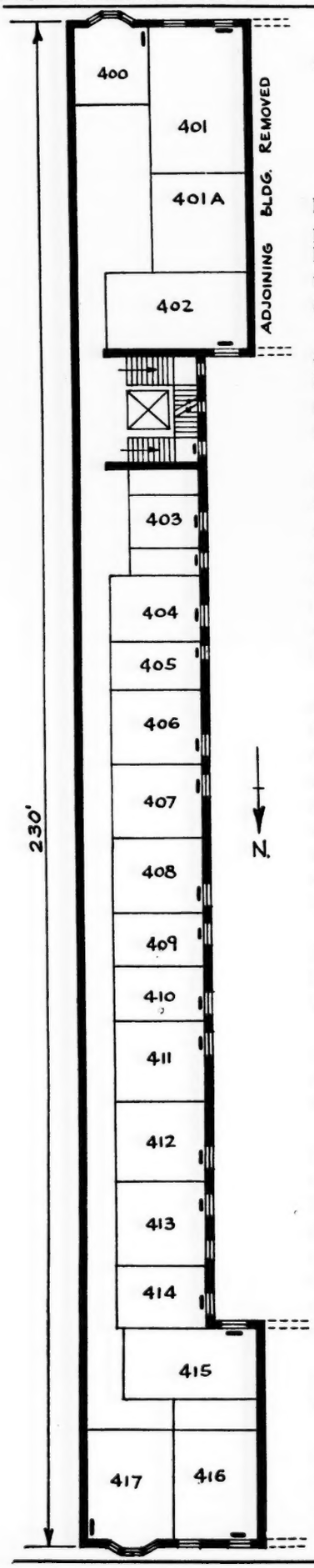
Hotel Slashes Fuel Costs

In heating a building, proper distribution of radiation is an important factor. This is especially true with one-pipe steam systems, where the radiators are either full-on or full-off, and cannot be throttled as can a two-pipe trapped installation. In many of the older office buildings and hotels, built when one-pipe steam was considered the cheapest system to install and operate, waste of heat results from improper distribution of radiators. Where certain rooms are under-radiated and a high boiler pressure is carried to supply steam to these units, other rooms in the building which have excessive radiator capacity become overheated, occupants open windows rather than turn off radiators, and a waste of heat results. All this illustrates the fallacy of comparing efficiencies of different plants according to the amount of fuel burned per square foot of installed radiator.

Consider the case of a six-story hotel, containing 102 rooms, with stores and a restaurant on the ground floor, heated by one-pipe steam. After an adjoining building on the west was torn down to provide a parking space, the north and south wings of the building had only 75% sufficient radiator capacity, while the middle section, constituting 60% of the total load, had 20% too much. In attempting to supply adequate heat to the wings, the boiler was forced and the middle rooms overheated. The coal consumption during a 4800 degree-day season was at the rate of 77 lb. per sq. ft. of equivalent direct radiator.

Balancing the radiators according to the figured requirements, through the exchange of some of the existing units, and the addition of others, provided the required heating. Although the total load remained practically the same as before the changes, the coal consumption was reduced to 59 lb. per sq. ft. for a comparable heating season.

This resulted in a saving of 34 tons at $6.50 per ton, or $221 in coal, and about $14 in ash removal, a total saving of $235. As the cost of making the changes



Typical floor plan of hotel described in case 1

was $420, the return on investment was better than 50%. More important was the fact that the hotel guests were satisfied with heating conditions.

Loft Reduces Coal Cost 44%

Savings largely due to rearrangement of piping were effected in an eight-story loft building, containing over 800,000 cu. ft. of heated space, and heated by two-pipe steam. Because of the improper grading and size of some of the old pipe lines, 10 to 15 lb. steam pressure was required for normal operation. As most of the radiators in vacant spaces were kept turned off, the net heated volume was about 630,000 cu. ft.

For a 4600 degree-day season the coal consumption of 336 tons at $4.78 cost $1605. The capital investment required for a revamped system of piping, installing a vacuum pump and radiator traps, adding radiation in certain under-heated spaces, replacing wall pipe coils with direct cast iron units, and insulating supply piping, was $3950.

Under the proposed changes, although 500 sq. ft. of additional radiation would be provided, the total equivalent load would remain unchanged, due to the elimination of pipe coils and the covering of supply lines. For a comparable season of 4600 degree-days the coal consumption was estimated at 150 tons, and the savings at $960, which included coal supply and ash removal, in addition to which the building would be satisfactorily heated. The building income, however, did not warrant the expenditure of $3950 at the time. In fact, $500 was the limit the owners were willing to spend, and they had to be guaranteed a good return before they would authorize that amount.

The ground floor was occupied by stores, in which the radiator surface was about 800 sq. ft., and which were supplied by downfeed risers. In order to heat the stores the entire system of piping throughout the building was in use. The stores remained open until 10:30 p.m., and until midnight on Saturdays, although all other tenants were out of the building by 6 p.m. With a separate valved supply to the store radiators, the main building riser could be throttled after 6 p.m., and such an arrangement was estimated to show a large saving in coal. Including necessary regrading of basement condensate lines and runouts, elimination of certain piping, and insulation of basement supply mains, but not including any radiator changes, the total fuel saving was estimated at 120 tons.

The changes as above outlined were made at a total cost of $486, the work being done by the operating engineer and mechanics employed at the building. During the year following the changes, the coal consumption was reduced from 146 lb. to 82 lb. per degree-day.

Based on a 4600 degree-day season, this represented a saving of 147 tons. Including ash removal, the total monetary saving was $762, and the return on investment better than 150%. As the heated space in use was about 630,000 cu. ft., the coal consumption became 0.13 lb. per 1000 cu. ft. per degree-day.

Compare this with a six-story loft building of similar construction, adjacent to the loft just described, having 550,000 cu. ft. of heated space in use. Each of the six floors had a separate heating supply line, valved at a basement manifold. The operating engineer regulated the heating on each floor according to the temperature requirement of each tenant. On vacant floors, and on floors where the tenants used 100 lb. of steam from a separate boiler for tailoring irons and presses, the heating supply was throttled to prevent waste. During a 5000 degree-day season, this building used 133 tons of coal, or at the rate of 0.097 lb. coal per degree-day per 1000 cu. ft.

Although the cost of installing an individual supply to each floor adds to the first cost, the economy obtained generally makes such installations warranted in loft type buildings.

This is the first of a series of articles by the author on modernizing the mechanical equipment of buildings. Additional cases reporting how engineers and building owners have worked together in bringing plants up to date, with resulting savings in operating costs, will be described in future articles which will appear from time to time.

Broadway Restaurant Cooled by Air Blanketing Heat Source

At least two novel features are found in the engineering of an air conditioning system which modernizes a small but prominent Broadway, New York, restaurant and lunch counter. Briefly, these are, first, the isolation of heat generating cooking apparatus in the front window by means of a cool air current passed between this area and the body of the restaurant, and second, blowing cool air out the front door to advertise to passers-by that the establishment offers relief from summer's heat.

The lunchroom, known as the Mayflower Doughnut Shop, is owned by The Doughnut Corporation of America, which also owns and manages nine other similar shops in as many cities. To emphasize the food specialty a modern doughnut cooking machine was placed in the front window. Despite the fact that there was placed in the ceiling, directly over the machine, an exhaust grille which led to a cased exhaust fan, experience showed that heat continued to be released to the restaurant seating area, thus making patrons uncomfortable.

One of the remedies was the installation of ceiling-hung glass panels, or drops, between the street window and the seating area. These partially enclose the machine and are 4 ft. deep. Further, two grilles of a new cooling system were placed in such a manner as to blow cool air along the front of the machine compartment, this grille being in the wall near the floor. A second cool air stream is directed across the machine front (interior front) from an overhead grille. This arrangement is said to afford relief previously sought in two different installations of different types. The modernization contract was awarded to John C. Pearce, a ventilating contractor of New York.

One of the interesting features of the Mayflower job is that, although the establishment is barely more than 30 ft. x 30 ft. there are included in the fan system seven air supply grilles. This is held to afford better-than-ordinary air distribution without drafts noticed by patrons seated at counters only a few feet distant from points of delivery.

Outside air supply is taken from a side street, 16 ft. above the sidewalk. It then passes through a dry sectional filter, over heating and cooling coils, through the fan and thence to the ducts.

Rather than have ducts concealed in the ceiling, which would have been difficult if not impossible, due to lack of space, ducts were run adjacent to the ceiling and are 2 ft. x 2 ft. Concealment of the duct is obtained by polished clay tile covering, so that the duct

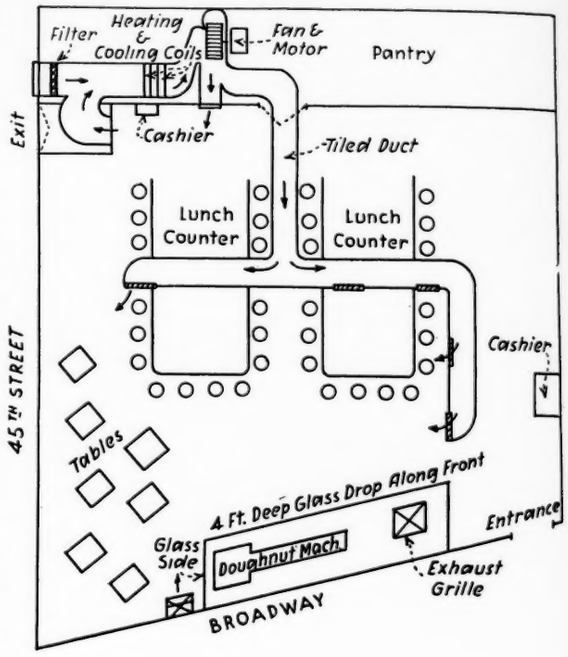
Interior of the small Broadway restaurant devoted to "Glorifying the Doughnut." Air conditioning ducts at ceiling level are concealed by a tile covering.

now has the same appearance as the walls of the room.

In the face of the delivery duct are six air supply grilles, while a seventh supply grille is in a rear wall 8 ft. above the floor. As the ceiling-hung duct pursues a T- and L-shaped course through the restaurant and most of the supply grilles discharge towards the front, or Broadway, side of the room, a slight pressure is built up. This causes cool air to pass to the sidewalk through the open entrance door. The refreshing cool air advertises that the establishment is air conditioned.

Many of the details of the modernization work here conducted must be omitted here, yet it should be noted that the contractor also installed an exhaust ventilation system in the room directly above the restaurant to remove heat from three doughnut machines there. Machines are hooded, and heat and odors pass through a trunk duct to a large cased fan that discharges out an upper window.

There also was installed by the contractor a small centrifugal exhauster in the machine room below the restaurant to remove heat generated by electrical machinery there. Without this relief it is held that this room would be practically useless. The installation in the Mayflower shop led to the award of several more similar jobs in other cities where this proprietor's restaurants have been modernized in much the same manner.



Layout of the Mayflower Doughnut Shop.

Oxy-Acetylene Welding Aids Heating Modernizing

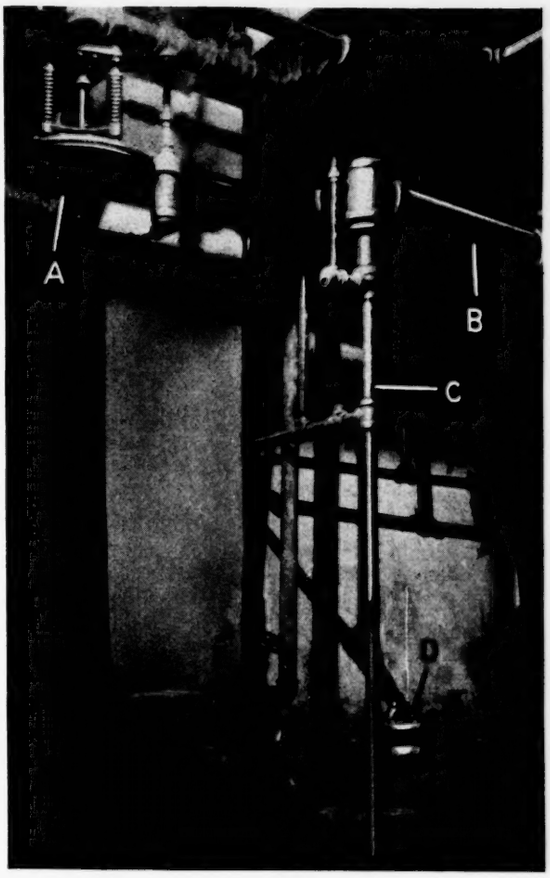
IN connection with the modernization of older dwellings, the expense of the modernization work can be considerably cut down by the use of welded piping. To rip out an old boiler with its incidental fixtures and place a new modern unit in its place entails considerable work on the existing piping system. Here again a great deal of work can be eliminated, and a much better appearing room will result if the oxy-acetylene process is used.

One prominent heating contractor in the east is particularly well pleased with the savings in labor and material made possible by the use of the oxy-acetylene process. He states that he has been able to reduce his labor costs 50%. The finished jobs have a fine appearance, most pleasing to the owners. This firm has standardized on using the oxy-acetylene welded installation idea as the first factor or inducement in the sales presentation. This is particularly true when the changeover will take place in cold weather. Prospects are quickly convinced of how rapidly an installation can be made, as well as of the superiority of the welded construction.—*Oxy-Acetylene Tips.*

New Piping and Traps Eliminate Hammering, Cure Sanitarium's Heating Troubles

RELIEF from water hammering and maintenance of room temperatures at the comfort point were the objects of a heating modernization contract executed at the Rivercrest Sanitarium, Astoria, L. I., a private neurological hospital. Prior to the recent improvements the existing heating system was found to have many shortcomings. Not only did pipe hammering interfere with the treatment and sleep of the patients, but room temperatures in the men's dormitory were such as to force patients to bed early to keep warm.

This institution's age exceeds a quarter of a century. The old heating system in service for many years was of the two-pipe gravity flow type. The probability is that it was fairly satisfactory in its early years. About three years ago pipe hammering became troublesome, while leaky joints, possibly diversion of the steam supply to other buildings, and other causes seriously interfered with the ability of the boilers to provide adequate heat, especially in the men's dormitory, and in addition the noise was unpleasant.



Piping changes in the sanitarium system. A—pressure reducing valve; B—steam main; C—drip pipe; D—trap.

A well intentioned craftsman undertook to correct the faults two years ago by adding several new risers and radiators without, however, increasing main and return pipe sizes. Instead of remedying the hammering the annoyance became accentuated, due to the congestion of condensate in the returns, some of which were but 1 in. The supply mains in no case exceeded 2 in. Engineer Frank M. Meyers, Woodside, L. I., was called in and brought to light several important points that prevented the success of the old, or existing, system.

One point that someone evidently failed previously to take into consideration was the fact that the power plant is 250 ft. distant from the dormitory building and considerable downgrade from the hospital structure. Pipes were buried. A check-up of existing radiators revealed, further, that the total, including pipe radiators, was only 2,602 sq. ft. It was recommended to increase this to 4,831 sq. ft.

Another point was that one wing of the dormitory building was lower than the flow and return lines where they entered the building. Thus successful condensate return could not be effected except by trapping or otherwise placing the line under positive motivation. The old steam pressure was 25 lb. The engineer had a pressure reducer installed to cut this down to 5 lb.

The steam supply main had to be enlarged from 2 to 4 in. and the return enlarged. Positive return of condensate was accomplished through the installation of a combination trap in the building's basement. Formerly all condensate was drained to the sewer. Addition of the trapped returns and connection to the feed water pump and receiver in the power house now enables the hospital to save the hot condensate, with substantial saving of fuel and water.

Another feature of the modernized system is the dripping of the steam supply mains. Two small traps also were added to insure the return of condensation from the low wing. Many risers had to be changed and others soon will be. Many pipe lines were renewed and rejoined to prevent leaks and air entrance. Summing up, the increases in pipe sizes, plus the addition of the traps, has resulted in steady, positive flow of steam to all radiators with resulting satisfactory room temperatures. The tightening of the system, plus proper venting and drainage of lines, has done away with pipe hammering. Personal complaints have ceased and the system now is more economical to operate.

GETTING DOWN TO FUNDAMENTALS

4—Estimating the Amount of Ventilation Air Necessary

Foreword

IN previous articles in this series the nature and direction of flow of the heat quantities on which the usual estimate is made have been described. They were shown to be divisible into (a) transmitted heat, (b) heat from filtration air, and (c) heat from ventilation air. It was also noted that these quantities can be expressed mathematically in the following equations:

$$\text{Transmitted Heat} = H = AU(t_i - t_o) \quad (1)$$

$$\text{Heat from Filtration Air} = F = \frac{C(t_i - t_o)}{55} \quad (2)$$

$$\text{Heat from Ventilation Air} = V = \frac{C_v(t_i - t_o)}{55} \quad (3)$$

In these equations: H, F, and V are all in B.t.u.'s per hour:

A = Area, sq. ft. of surface through which heat passes
U = The transmission coefficient, air to air
C = Volume of filtration air flowing, cu. ft. per hr.
C_v = Volume of ventilation air flowing, cu. ft. per hr.
t_i = Temperature of indoor air, °F.
t_o = Temperature of outdoor air, °F.
$1/55 = 0.018$ = heat to raise 1 cu. ft. of air at 70° through 1°

It was also noted that the three equations are not usable until values are available for substituting in them.

In the second article the fundamentals of arriving at suitable values of t_i and t_o were discussed and tables were presented for use in finding suitable values of them. In last month's article methods of computing the Heat from Filtration Air were described, and tables were presented for selecting suitable values of C in equation (2).

We can now turn attention to equation (3) and consider what is necessary to permit its use in estimating the Heat from Ventilation Air. With values of t_i and t_o already established the only remaining term not having a value for practical use is C_v.

By definition, C_v is the volume of ventilation air flowing, in cubic feet per hour. Since the estimate is usually prepared to arrive at a figure to represent worst, or least favorable, conditions it follows that the volume represented by C_v is the amount flowing at the particular time when conditions are worst, or when there is peak operation of the plant. Usually, but not always, the peak condition occurs on or near the coldest day in winter or the hottest day in summer. To make the use of the equation logical and consistent, the amount flowing should be established at the time when the values selected for t_i and t_o are present.

It is well too to get clearly in mind again just what is meant by ventilation air and what it implies, before attempting to set any numerical values for C_v. We have called it the air which is *deliberately* circulated through the building, from outside to outside. Since during the peak periods the circulation of this air is accompanied by a loss or gain of heat which is usually unwanted, it is self-evident that the air so circulated will increase both the size and first cost of the installation and the cost of operation. From this it follows that all dictates of reason call for keeping numerical values of C_v as small as possible. It also follows that it would be utterly nonsensical to circulate costly air into a building and back out again, and to do this deliberately, unless there was some definite and worthwhile objective to be accomplished by so doing.

All these statements are elementary and largely self-evident but strange as it may seem they are all too often overlooked or forgotten. Having them fresh in mind permits setting up the following general rule of procedure to act as a guide.

Be sure that the objective in using ventilation air at all is not only clear, and correctly understood, but that it is defensible and logical in the particular case under consideration. When satisfied of this, then try to keep the amount of ventilation air at a minimum to accomplish the particular objective.

In short, the process of arriving at suitable amounts of ventilation air really ought to be a two-stage process. Quite generally it is not, or at least is not clearly recognized as such. No doubt the failure so to recognize it is the underlying cause of much of the loose thinking, faulty selection of air quantities, failure to provide ventilation where really necessary and the equally absurd trouble of including it where there is little or no excuse for ever having it at all. To avoid this trouble so far as possible let us follow this two-stage process in our present discussion.

Objects of Providing Ventilation Air

Following this method we immediately come to the question—just what possible objectives are there to be gained which may justify deliberately taking ventilation air into a building or structure, and back out again?

While there may be isolated cases where there are other objectives, the great majority can be grouped under two heads, viz.:

1. Where the intent is to use the air introduced to improve or replace or dilute the air in the building in such a way that the *people who occupy* the building or structure will be benefited to such an extent as to justify the added cost. This benefit may be in terms of more or better work, increased comfort, improved health, or even increased pleasure or enjoyment of the surroundings, or a combination of all these. The important point is that the primary object of circulating the air is tied up with the *people* in the building.

2. Where the intent is to use the air for the purpose of affecting or improving (or replacing or diluting) the air in the building in such a way that *a process* (other than a human process, and usually a manufacturing or industrial process) can be accomplished better or more cheaply to such an extent as to justify the added cost. The benefit may be in terms of increased output of product, less spoilage of product, more possible working days per year, or improved quality of product. The important point is that the primary object of circulating the air is because of processes (other than human) in the building.

For short, we can call the cases falling in the first group Human Ventilation, and those in the second group Process Ventilation.

It will be seen at once that this division is not strictly logical for there will be marginal cases where there is some doubt as to just what the primary object is, since people are usually present in buildings where processes are carried on. In some of these borderline cases it may be hoped that both process and people will reap some benefit from the circulation of ventilation air through the building. However, this grouping is adequate for most purposes and has the advantage of closely paralleling a classification of cases which seems to be coming into fairly general use. Moreover, this grouping has the practical advantage of permitting separation and separate consideration of two kinds of installation which occur frequently in practice.

At this point it is well to recall that when the major objective is thus clarified it is logical to decide just what is to be done to the ventilation air during the course of its passage through the building before any light can be shed on the question of air quantity needed. The reason for this is that the quantity necessary depends on just what is to be done to the air in order to permit it to accomplish the objectives sought.

Processes thru which Ventilation Air Passes

Recall that it is possible to (a) clean or purify, (b) heat or cool, (c) humidify or dehumidify, or to do any or all of these processes to the ventilation air anywhere between its entrance into the building and its departure. It is also possible to carry on the same processes on the air already in the building. Bearing in mind the principle that no more ventilation air should be deliberately circulated into and out of the building than necessary, it is apparent that the processing of the air should be performed on the air already in the building when this is possible. Only when this practice will not accomplish the objective should air be brought into or exhausted from the building. This is true regardless of whether the ventilation air is for use in connection with human ventilation or process ventilation.

Let us now see how the several processes which can be applied to the air, and listed in the previous paragraph, affect the necessity of deliberately circulating ventilation air through the building.

Effect of Heating or Cooling

Suppose, first of all, that it is only proposed to heat or cool the air and that it is not necessary to artificially change the humidity or the purity. There is no known evidence that merely heating or cooling air over and over again within the limits of common practice produces changes in the air which make it necessary to bring in any outside air over and above that which normally finds its way through by involuntary filtration. Stated another way, common experience leads to the conclusion that where only the usual amount of heating of the air is practiced in winter or where a slight degree of cooling in summer will produce the hoped-for objective, the practice of full recirculation of air can be used. Leakage air will in these cases take care of any necessary outside air quantities. Typical places where such conditions exist are in the usual residence in winter, and in factories and industrial or commercial buildings where density of occupancy is not great and where processes do not add excessive humidity or contaminate the air more than slightly. Common practice recognizes this condition and such buildings are but rarely equipped to deliberately pass ventilation air through them at all times. Some means of intermittent ventilation is usually provided though, either in the form of window openings or in similar ways. The point is that since the deliberate introduction of ventilation air is not necessary at all times it can be practiced at some time other than when the heating or cooling plant is operating at peak. Since C_v is taken at the time of peak it is common practice to consider its value as zero in such buildings in preparing heating estimates by use of equation (3).

Whether similar treatment of such buildings is fully justified or not in summer is still a debated point. Where artificial cooling is practiced with dehumidification the tendency is to regard C_v as being zero in such buildings, at least in the light of present knowledge. Where some cooling of such buildings is practiced by deliberately circulating outside air during night or day hours the tendency is exactly reversed and the value of C_v is set high, as it seems necessary to circulate very large quantities of outside air to accomplish much effective cooling by such methods alone.

Now let us similarly consider how humidification or dehumidification alone affects the quantity of deliberately circulated ventilation air.

Humidifying or Dehumidifying

There are two cases. One is where for some reason with full recirculation of air the tendency is for the humidity to remain or become too high to secure the objective sought and therefore dehumidification must be resorted to. Evidently in this case the object of introducing ventilation air to replace a part of that recirculated would be to reduce the dehumidification required without it. The other case would be where the humidity was too low with full recirculation and ventilation air would be used to lessen the necessity of so much humidification.

Cases of excessive humidity with full recirculation are fairly common in practice. Wherever conditions are such that moisture is being steadily evaporated into the air the degree of humidity will often become greater than that desired, and means must be found to reduce it. Examples are theaters in summer, schools in winter, and dyehouses and similar process buildings. Among the various possible means of reducing the humidity, the introduction of ventilation air can be considered. It will be effective if its introduction has the net effect of lowering the humidity without at the same time introducing some other factor which offsets this advantage. There are cases where introduction of such air is advantageous and its use is practiced. In school buildings using fan systems this practice is common. Mere introduction, however, does not mean that the heat quantity enters into the estimate of peak requirements though, for air so introduced may not have to be used at the time of the peak load.

Cases of deficient humidity with full recirculation are also fairly common in practice. To overcome the deficiency moisture must be added. While outside air in some localities and at certain times of the year might be introduced to advantage, it must be recalled that artificial humidification of air can be fairly conveniently and cheaply done. In many, if not nearly all, cases it will prove more advantageous to continue to recirculate and add moisture artificially than to bring in outside air deliberately to secure the same effect.

Thus it is evident that while changes in humidity do have some effect on the amount of ventilation air necessary, it is of great practical importance only in a few special cases, prominent among which are in the winter operation of schools, summer operation of theaters, and similar buildings.

Now we come to the interesting case of changes in the purity or cleanliness of the air. We will examine it in the same way as was just done for temperature and humidity changes.

Air Purification

Again the most economical method would be to practice the desired purification, or cleaning, on the air already in the building. Any of the several means of purification or cleaning can be applied to the recirculated air.

In recent years increasing attention has been devoted to the subject of removing solids from air and as a result there are now available as standard equipment a variety of devices for removing dirt, dust, and other solids from air either as it enters or leaves the building or as it passes any suitable point in the system. Cleaning, as regards removal of solid substances, has now reached such a point that by one means or another such as passing the air through labyrinths, through water (or other liquid) sprays or streams, through fabrics or fibrous layers or by impinging it on adhesive surfaces, a high degree of solid removal can be reached. Indeed it seems concludable that where there is no other element in the purification problem except removal of solids, this can be accomplished sufficiently well and cheaply with recirculation that the deliberate introduction of ventilation air is scarcely necessary. Only in specialized cases usually involving process work in industry where the concentration of solids is exceedingly great is it economical to introduce ventilation air. Such cases require careful study and close estimates. All this can be summed up by stating that where removal of solids is the sole purification problem, there is little effect on determining values of C_v.

Bacterial contaminations occasionally present a problem in air purification. In general such contaminations when serious enough to require special measures of purification are not continuous. They are more of the nature of emergencies. As such they are usually considered as requiring emergency handling and no special arrangements are made to permit such purification in the ordinary day-to-day operation. While little is definitely known as to just what harmful bacteria are really air borne, it is generally accepted that the bacteria are conveyed on particles of vapor or solid particles in the air rather than by the gaseous air itself. At any rate it has been shown in tests that reducing the concentration of solids in the air results in reduction of the bacterial count. Because of the uncertainties, the awkwardness of providing equipment for full bacterial purification, the emergency nature and infrequent appearance of really serious bacterial contamination, and the fact that the necessity for it has not been demonstrated, it can be concluded that seldom is the question of bacterial removal one which in practice exerts much effect in fixing values of C_v.

Air inside buildings is also often contaminated by gases or vapor (other than water) arising from processes. These may or may not contain objectionable odors, but do present a problem because of unwanted properties of other kinds. Some are poisonous to humans or they may be dangerously corrosive either to tissues or materials. These substances which contaminate the air are commonly grouped as "fumes." The effect of their presence in fixing values of C_v depends on the nature of the contamination, its extent, and on the feasibility of various possible methods of removing their nuisance effect. In general, while possible, it is not practicable to remove any substantial amounts of such contamination from the air already in the building and thus make it suitable for recirculation. Consequently it is necessary to replace the contaminated air with air brought in from outside. Values

TABLE 1. VOLUME OF VENTILATION AIR FOR VARIOUS TYPES OF BUILDINGS

(As found in various textbooks, reference books, catalogs, and other publications. Total volume (C_v) in cubic feet per hour can be computed from unit figures below, as shown at the top of each column.)

Type of Building	No. of Changes per Hour, (n). $C_v = n \times$ Room Vol.		Cu. Ft. per Occupant per Hour, (A). $C_v = A \times$ No. Occupants		Cu. Ft. per Sq. Ft. Floor Surface per Hour, (B). $C_v = B \times$ No. Sq. Ft.	
	Min.	Max.	Min.	Max.	Min.	Max.
Commercial						
Garages	6	12	—	—	—	—
Offices	1½	12	—	—	—	—
Waiting rooms (public)	4	6	—	—	—	—
Restaurants (dining)	4	20	—	—	—	—
Restaurants (kitchen)	4	60	—	—	240	240
Stores (retail)	6	12	—	—	—	—
Farm Buildings						
Cow	—	—	3000	6000	—	—
Horse	—	—	3600	4200	—	—
Hog	—	—	1200	1500	—	—
Sheep	—	—	600	900	—	—
Hospitals						
Dining rooms	6	12	—	—	90	90
Kitchens	20	60	—	—	240	240
Operating rooms	—	—	3000	3000	—	—
Toilets	7.5	30	—	—	120	120
Wards (ordinary)	—	—	2100	4500	60	60
Wards (contagious)	—	—	2400	6000	—	—
Hotels						
Barber shops	7.5	7.5	—	—	—	—
Cafes	7.5	7.5	—	—	—	—
Dining rooms	4	20	—	—	90	90
Guest rooms	3	5	—	—	—	—
Kitchens	4	60	—	—	240	240
Lobbies	3	4	—	—	—	—
Lounges	6	6	—	—	—	—
Toilets	10	12	—	—	—	—
Industrial						
Bakeries	20	20	—	—	—	—
Factories (general)	1	12	1500	2000	—	—
Factories (unhealthy)	—	—	3500	3500	—	—
Foundries	3	12	—	—	—	—
Laundries	12	30	—	—	—	—
Paint booths	0	600	—	—	—	—
Paint rooms	30	60	—	—	—	—
Textile mills	4	4	—	—	—	—
Prisons						
Single cells	9	12	—	—	—	—
Sleeping cells	6	6	—	—	—	—
General quarters	6	6	1800	1800	—	—
Residences						
Bathrooms and toilets	1	5	—	—	—	—
Halls	1	3	—	—	—	—
Kitchens	1	40	—	—	—	—
Living rooms	1	2	—	—	—	—
Sleeping rooms	0	1	—	—	—	—
Social, Recreational, Public, Educational and Religious						
Assembly rooms, including concert and dance halls, lodge rooms, church and theater auditoriums	4	30	600	4000	90	120
Billiard and bowling	6	20	—	—	—	—
Classrooms (colleges)	—	—	1500	2400	—	—
Classrooms (schools)	—	—	1800	2400	120	120
Corridors	4	4	—	—	30	30
Dining rooms	5	20	—	—	90	90
Gymnasiums	12	12	—	—	90	90
Kitchens	15	60	—	—	120	120
Laboratories	6	20	—	—	—	—
Locker rooms	2	10	—	—	120	120
Projection booths	30	30	—	—	90	90
Reading rooms	3	5	—	—	—	—
Toilets	10	30	—	—	120	120
Engine and Boiler Room	3	12	—	—	—	—

of C_v in such cases will be greatly affected by the particular system of ventilation used. General practice is to use the principle of removal at the source and to localize the circulation. Where this is done it is usually possible to accomplish the desired result with considerably smaller quantities of ventilation air than if the general air of the building is used to supply motive power to carry the offending fumes out of the building.

One of the most troublesome cases of air purification is that which arises where odors are present or generated to such an extent as to become a problem. One fact which makes the problem troublesome is the lack of information as to what causes odors and an equally distressing absence of any absolute scale for measuring their nature or intensity.

Since odor is purely a sense impression, the problem arises only where there are people present to sense it, although the odors may arise in either process or human jobs.

Another point in connection with odor problems which should be kept in mind is that odors themselves, except where they arise from substances otherwise harmful to persons, have never been shown to have any especially dangerous qualities. Their removal from air is usually undertaken for purely aesthetic reasons or because of their constituting a nuisance.

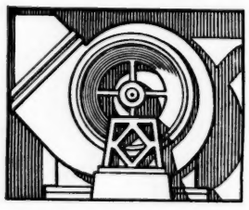
Several methods of approach to the odor problem have been proposed and used to varying degrees. They are (a) prevention, (b) masking, (c) removal, (d) dilution.

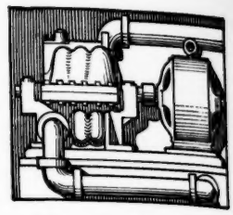
Preventive measures are practiced at the source and if successful the odor problem has no effect on the amount of ventilation air required at peak operation.

Masking consists of introducing a pleasing odor to cover up an unwanted one. Ozone is by some considered a mask and by others as a remover of odors. Masking has limited applications and while it may affect the amount of ventilation air necessary in some cases it is not generally considered as a governing factor.

Deodorizing is used either by injecting some substance like ozone into the recirculated air stream or by passing the recirculated air through a layer of deodorizing chemical such as certain forms of carbon. Where successful it permits use of either all the air for recirculation purposes or greatly diminishes the severity of the problem.

Dilution consists of bringing into the building and mixing with the air already there enough odor-free air to reduce the intensity of the odor to a point where the objective is reached. It may vary all the way from using only a small amount of such air and a large amount of recirculated air to the point where there is no recirculated air. Since it is economical to keep the outside air at a minimum, it is especially desirable to do this where the cost of introducing outside air is greatest. This occurs at peak time and is especially desirable at the time of the summer peak when artificial cooling is being used. The growing importance of cooling has led to close attention being paid to the minimum amount of dilution air necessary in summer to keep odors arising from recirculated air from becoming offensive. While some progress has been made there is no evidence that the actual minimum is yet fully established.





However, it can be accepted as a fact that the prevention of odors on summer comfort work does exert a great effect on establishing suitable values of C_v for summer practice, and is also an important factor in setting winter values especially where it is desired to achieve the operating economies possible by practicing recirculation.

We may sum up all these considerations by noting that values of C_v are affected little by ordinary heating or cooling alone, that humidification or dehumidification can often be readily accomplished with but little ventilation air, and that odor problems frequently greatly affect the amount of ventilation air required.

Amounts of Ventilation Air Used in Practice

Having thus noted the nature of the values of C_v desired, and some of the factors which might be expected to fix the values for practical use, we can turn attention to the matter of seeing what is available to anyone who wants to find values for use in preparing estimates.

Table 1 has been prepared by carefully reviewing and tabulating values as reported in standard textbooks, handbooks, catalogs, and similar publications. It will be noted that there are three kinds of figures given. Those in the first column are in terms of number of air changes per hour, those in the second in cubic feet per hour per occupant, and those in the third are in cubic feet per hour per square foot of floor area. The method of arriving at a figure of the nature of C_v in equation (3) is indicated at the top of each column.

Another point about the figures given is the great range covered by many of them. Thus in the case of paint booths the figures show that from zero to 600 air changes per hour are required. With such a range the estimator must evidently have some additional information before he can decide where his particular job falls in between these wide limits. Thus the figures must be used with the greatest care and only after careful thought to select one which fits the case. An intelligent selection will necessarily require experience. In other words the table, while it can be made helpful, in no way sets up a specific rule of practice—it merely serves as a guide based on the findings of others. It is thought to be the most complete compilation of ventilation air quantities put together in a single table. Nevertheless, it does not furnish enough information to satisfy all the fundamental requirements. There are other sources for finding values for C_v and some of these will be considered in a later article.

Design, Installation, and Operation of an Institutional Heating Plant

4—A Million Dollar Heating Plant at The University of Texas Generates Power as a By-Product

By CARL J. ECKHARDT, Jr.†

IN 1928 The University of Texas constructed a main heating and power plant in one corner of its then comparatively small campus. This same campus has been extended until it now embraces 192 acres. As a result of this extension the plant is now located near the center of the present campus.

The principal purpose for which this plant was constructed was to provide steam for heating, utility, domestic, and experimental purposes and to generate electrical energy required by the institution. It also serves as a laboratory for engineering students who may here test and operate equipment of a commercial size and nature.

In keeping with the Institution's policies with regard to the decoration of its buildings the main heating and power plant was constructed to commemorate those engineers and scientists who ranked preeminent among the individuals responsible for the development of the arts and equipment upon which the generation of the services provided are dependent. The drawings on the following two pages show the commemorative friezes which adorn the walls of the plant. The friezes commemorate Archimedes, Hero, Newcomen, Savery, Franklin, Watt, Faraday, Carnot, Corliss, Joule, Rankine, Clausius, De Laval, Zeuner, Steinmetz, Edison, and Westinghouse.

The source from which all energy, both heat and electrical, transmitted from this plant is derived is Texas Lignite. In a comparatively large area of Texas this fuel can be mined. This area, which embraces almost 60,000 square miles, has been estimated to contain approximately 23 billion tons of this fuel. This hitherto little used fuel, which consists of over one third water by weight, will no doubt ultimately be of great importance to the industrial development of the state of Texas.

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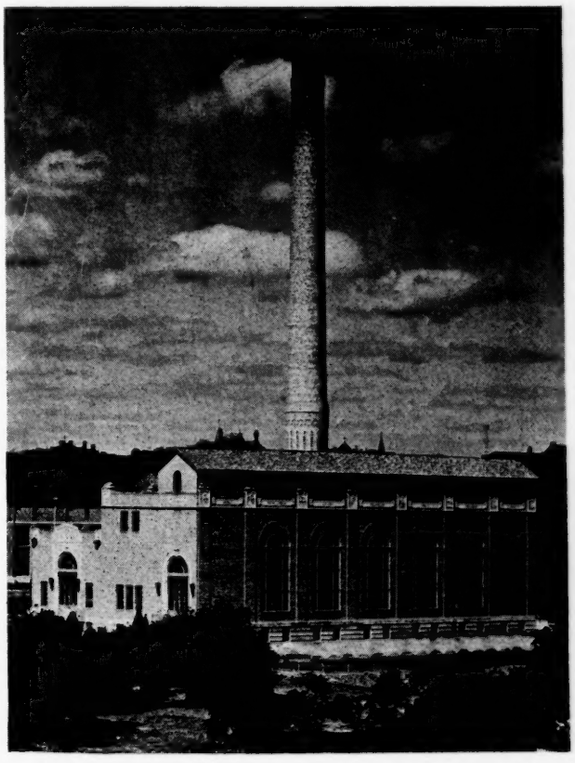


Main heating and power plant at The University of Texas

Fortunately, it has been possible to purchase this fuel at a figure so low that its use is more economical than that of the more desirable fuels, natural gas and fuel oil. This circumstance has made it possible for the University to undertake the task of developing means by which this fuel may be efficiently and economically burned.

The steam generating units originally installed were comparatively small and were designed to be operated at comparatively low ratings only.

When the Institution's 1931 building program was conceived, the engineers responsible for the operation of its utilities realized that the steam requirements of the University would no doubt be doubled, and that little more money would be available to provide this greatly augmented steam demand. For this reason it became necessary to design new equipment by means of which the heating requirements of the institution could be fulfilled at a materially lower unit cost. Some conception of the increasingly more complex nature of this educational institution is shown in Table 1.

This steam demand per student for heating, domestic, and utility purposes alone was increased by more than 75% in the period shown above. During this same interval the University began to generate its own power. As a result of this series of circumstances the total steam produced per year increased by more than 155% in a period of four years.

The following provisions were made in the new design of the steam generating unit in order to meet the increased demand at a lower unit cost:

1—To make possible a higher efficiency and a better economy a greater amount of heat absorbing surface in the form of superheater and air preheater was incorporated in the design of the latest unit.

2—The heating surface of the boiler was removed a greater distance from the

TABLE 1. STEAM DATA

Scholastic Year	Total Steam Produced, Lb. of Equiv. Evap.	Unit Steam Produced M. Lb. E. E. per 12 Mo. per Student
1929-30	64,186,200	12.26
1930-31	81,888,200	14.69
1931-32	79,008,800	13.47
1932-33	107,676,200	18.70
1933-34	164,050,000	26.64

TABLE 2. TYPICAL HEAT BALANCE OF NEW EQUIPMENT COMPARED WITH OLD

	New	Old
Heating value of fuel	100.0%	100.0%
Heat absorbed by water and steam	77.6	65.0
Heat loss due to moisture in fuel	5.0	6.0
Heat loss due to evaporation of water due to burning of hydrogen	4.6	4.1
Heat loss due to dry chimney gases	6.9	15.5
Heat loss due to moisture in air	0.3	0.4
Heat loss due to incomplete combustion	0.0	0.0
Heat loss due to unconsumed carbon in refuse	1.1	2.2
Unmeasured losses	4.5	6.8

fuel bed. This design permitted the reasonable operation of the plant at far higher ratings than had hitherto been possible.

3—To burn this free burning fuel with greater effectiveness a traveling grate type stoker which provided no agitation whatever was employed.

4—Use of a definite system of combustion air control made possible the provision of the proper air supply under all conditions of load so that the heat losses due to dry chimney gases were materially reduced by the reduction of excess air provided.

Modern Equipment Reduces Cost

A typical heat balance of the latest equipment operated under optimum conditions as compared with results with the old equipment is shown in Table 2.

Improvement in performance of steam generating equipment effected by the latest design indicates the fact that unit steam production costs were materially reduced by the use of the more modern equipment. In Table 3 the effect of the equipment on cost is clearly demonstrated.

TABLE 3. STEAM COST DATA

Scholastic Year	Total Steam Produced, Lb. of Equiv. Evap.	Unit Steam Production Cost, Dollars per M. Lb. Equiv. Evap.
1929-30	64,186,200	$0.504
1930-31	81,888,200	0.400
1931-32	79,008,800	0.370
1932-33	107,676,200	0.329
1933-34	164,049,100	0.275

While the major portion of this improvement must be attributed to better design, improvement in operating skill has been no small factor. The instruments provided have in each instance consisted of indicating, integrating, and recording equipment so arranged as to portray at all times the combustion and operation characteristics with which the operator on duty should be much concerned.

The 46% reduction in the cost of steam produced has reduced the University's annual expenditure by more than $37,000. Further reductions in total expenditures, however, needed to be made. A study of local conditions revealed the following:

1—The use factor of steam generating equipment due to the highly seasonal character of the heating load was necessarily low.

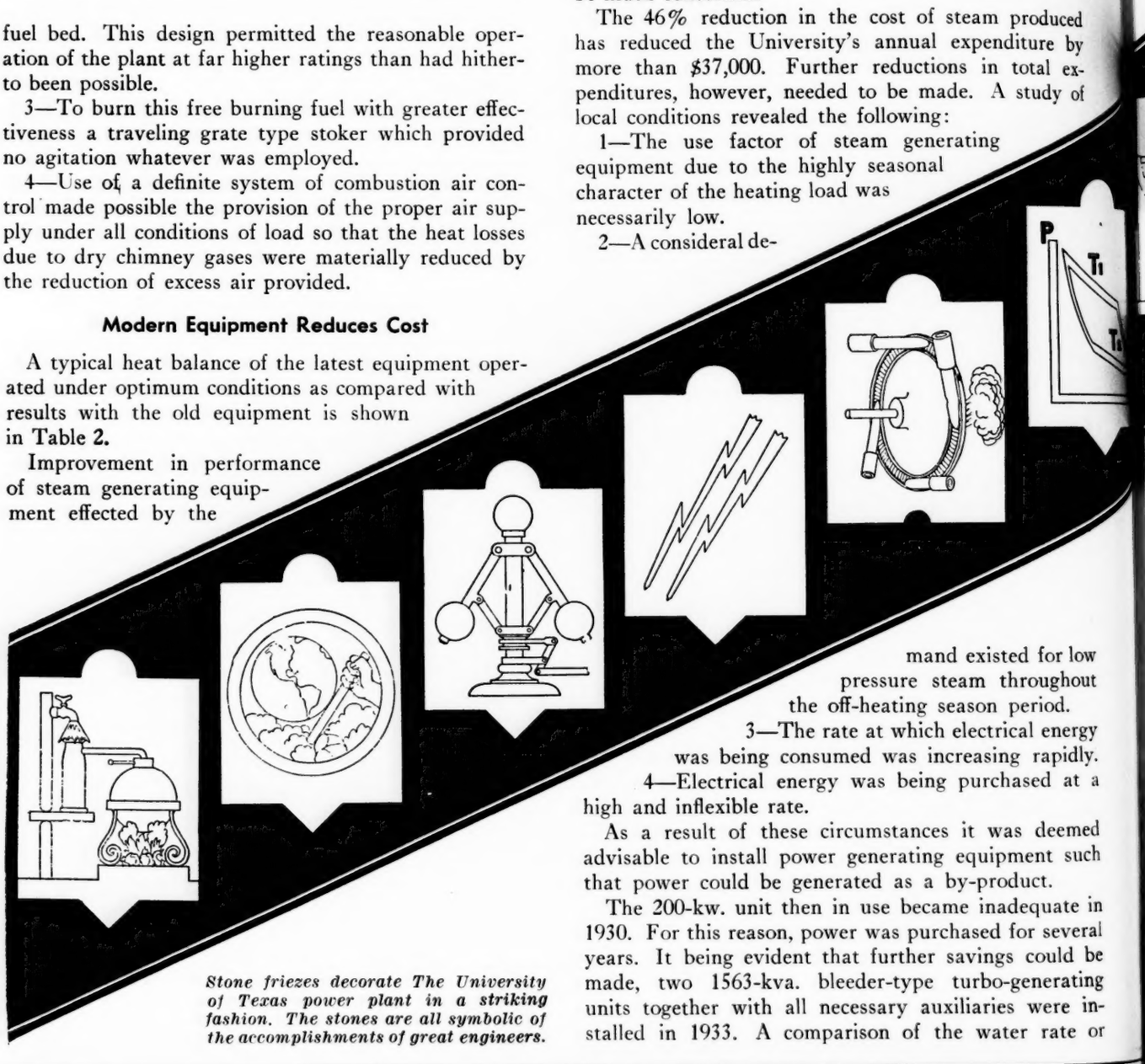
2—A consideral demand existed for low pressure steam throughout the off-heating season period.

3—The rate at which electrical energy was being consumed was increasing rapidly.

4—Electrical energy was being purchased at a high and inflexible rate.

As a result of these circumstances it was deemed advisable to install power generating equipment such that power could be generated as a by-product.

The 200-kw. unit then in use became inadequate in 1930. For this reason, power was purchased for several years. It being evident that further savings could be made, two 1563-kva. bleeder-type turbo-generating units together with all necessary auxiliaries were installed in 1933. A comparison of the water rate or



Stone friezes decorate The University of Texas power plant in a striking fashion. The stones are all symbolic of the accomplishments of great engineers.

steam consumption characteristics of the old and new equipment predicted the saving which could be effected by the larger and later equipment. Table 4 shows the steam consumption of each type of equipment.

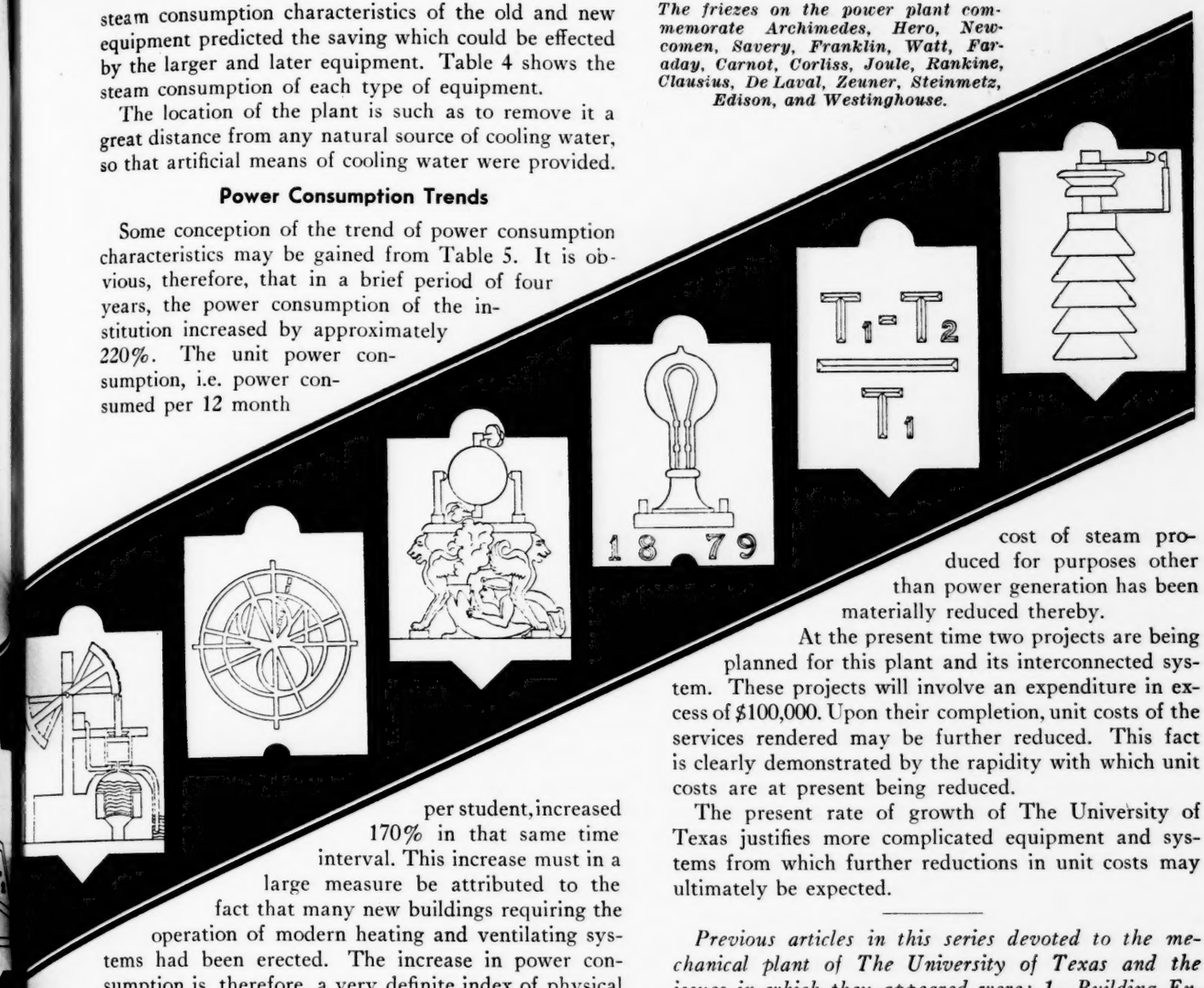
The location of the plant is such as to remove it a great distance from any natural source of cooling water, so that artificial means of cooling water were provided.

Power Consumption Trends

Some conception of the trend of power consumption characteristics may be gained from Table 5. It is obvious, therefore, that in a brief period of four years, the power consumption of the institution increased by approximately 220%. The unit power consumption, i.e. power consumed per 12 month per student, increased 170% in that same time interval. This increase must in a large measure be attributed to the fact that many new buildings requiring the operation of modern heating and ventilating systems had been erected. The increase in power consumption is, therefore, a very definite index of physical plant extension activity.

Fortunately, the expectations of the designing engineers were completely fulfilled in the performance of this equipment. Unit power costs were materially reduced as may be observed in Table 6.

At the present time power is being generated as a heating by-product at a rate which will effect an annual saving in excess of $25,000. At the same time the equipment provided primarily for heating purposes is being operated with a higher use factor, and the unit cost of steam produced for purposes other than power generation has been materially reduced thereby.



The friezes on the power plant commemorate Archimedes, Hero, Newcomen, Savery, Franklin, Watt, Faraday, Carnot, Corliss, Joule, Rankine, Clausius, De Laval, Zeuner, Steinmetz, Edison, and Westinghouse.

At the present time two projects are being planned for this plant and its interconnected system. These projects will involve an expenditure in excess of $100,000. Upon their completion, unit costs of the services rendered may be further reduced. This fact is clearly demonstrated by the rapidity with which unit costs are at present being reduced.

The present rate of growth of The University of Texas justifies more complicated equipment and systems from which further reductions in unit costs may ultimately be expected.

Previous articles in this series devoted to the mechanical plant of The University of Texas and the issues in which they appeared were: 1—Building Expansion Program, April; 2—Heating and Ventilating Requirements Met by Wide Variety of Systems, May; 3—Steam Distribution System, June. The next and concluding installment will be devoted to the complex temperature control system made necessary by the climatic conditions.

TABLE 4. STEAM CONSUMPTION DATA

Load	With 1928 Generating Unit 200-kw. Engine Generator Non-Condensing—Lb. per Kw-hr.	With 1933 Generating Units, 1563 Kva. Turbo Generator	
		Straight Condensing—Lb. per Kw-hr.	Steam Condensed When Bleeding 20,000 Lb. per Hr.—Lb. per Kw-hr.
¼	....	17.95	9.75
½	31.5	15.00	10.55
¾	30.0	14.00	10.45
Full	29.5	13.58	10.90

TABLE 5. POWER CONSUMPTION DATA

Scholastic Year	Total Power Consumed, Kw-hr.	Unit Power Consumed, Kw. per 12 Mo. per Student
1929-30	693,200	132.44
1930-31	941,400	168.92
1931-32	1,103,300	188.15
1932-33	1,177,100	204.49
1933-34	2,212,900	359.40

TABLE 6. POWER COST DATA

Scholastic Year	Total Power Consumed, Kw-hr.	Unit Power Cost
1929-30	693,200	$0.0203*
1930-31	941,400	0.0201*
1931-32	1,103,300	0.0182*
1932-33	1,177,100	0.0179*
1933-34	2,212,900	0.0112**

*Power purchased.
**Power purchased first two months and generated last ten months.

Air Conditioning and Research Papers Dominate ASHVE Technical Sessions

at summer meeting in Toronto. Discussion lively on heat pump, Chicago standards, and heat absorbing glass windows

THREE hundred and thirty-three members and guests attended the semi-annual meeting of the American Society of Heating and Ventilating Engineers held at the Royal York Hotel, Toronto, June 16-19. Society members were the guests of the Ontario chapter whose hospitality and consideration have not been exceeded in any meeting of this Society. Unfortunately, the social events, particularly the golf competition for the Research Cup, were somewhat handicapped by rain.

The first session was welcomed by M. W. Shears, president of the Ontario chapter, response being made by President John Howatt. This session was devoted primarily to research papers from the Society's laboratory.

The second session was devoted primarily to air conditioning papers.

Research has been under way for the last few years on investigating the possibilities of glass windows which will not pass all of the heat rays from the sun. This work is of primary importance in air conditioning where the solar heat energy is a material part of the load. W. W. Shaver, physicist of the Corning Glass Works, presented a paper entitled "Heat Absorbing Glass Windows" describing experiments conducted on this type glass carried on during 1934. The glass was a borosilicate heat resisting and heat absorbing plate 3 millimeters thick. This glass transmits 76% of the visible light as compared with 92% for ordinary double strength window of the same thickness; transmits 42% of the total solar energy as compared with 88% for ordinary weather and reflects 5% of the total solar energy as compared with 8% for ordinary weather.

The tests were conducted in two identical test houses on the roof of a four-story factory building in Corning, N. Y., each miniature house being 8 ft. x 8 ft. x 8 ft. and cooled by circulating ice water.

From the author's observations, the following conclusions were drawn:

1. A reduction in the cooling load varying from 9 to 28.5% was observed in a test house equipped with heat absorbing, heat resisting glass used as an outside window with ordinary glass in the inside sash and from 16 to 24% with single heat absorbing glazing.

2. With no cooling equipment in operation the test house with the heat absorbing double window combination averaged 7.3° lower maximum temperature on sunny days than a similar test house with ordinary glass in both outside and inside sash. With air conditioning equipment in operation, maximum recording thermometers with blackened bulbs, suspended inside the windows in the sunshine, averaged 10.4° lower when heat-absorbing glass was used.

3. Heat required in a 10-day period in a winter test was approximately 9% more in a test house having double windows with heat absorbing glass in the outside sash as compared with a similar house having ordinary window glass in the outside sash. A test house having double windows with heat absorbing glass in the outside sash required approximately 20% less heat than a similar house having single windows of ordinary glass.

In the discussion on heat absorbing glass several questions came up, among them one regarding the possibility of this glass losing its properties in the course of time. The author replied that the tints seemed to have an indefinitely long life. In reply to the question as to the relative cost of this glass as compared with ordinary plate, Mr. Shaver said that it is now available in plates at about three times the ordinary plate cost and in a thickness of about ⅛ in.

Last winter a heat pump, or reverse refrigeration machine, designed for heating a building as well as cooling it, was installed in a branch office in Salem, N. J., by the Atlantic City Electric Company. A deep well water supply was used as a source of heat in the winter and as a sump for the rejection of heat in the summer. The building is a two-story and basement, brick and steel reinforced concrete structure with a display room on the first floor and a demonstration room and auditorium on the upper floor. The heating requirements during zero weather were 143,000 B.t.u. per hr. for conduction loss, 107,000 B.t.u. for warming ventilation air, and 35,000 B.t u. for basement heat loss, a total of 285,000 B.t.u. per hr. under design conditions. For summer operation the first and second floors were designed to be cooled to 80° dry bulb with 50% relative humidity, when outside conditions were 95° dry bulb and 75° wet bulb. Allowing for 1200 c.f.m. of ventilation air, the maximum summer load is 108,000 B.t.u. per hr.

The system included a deep well pump with a 3-hp. motor which forces water through four water coolers in series. As refrigerant evaporators these units are connected to four compressors and thence to the condensers or air heaters as refrigerant circuits. Units 2 and 3 are arranged with reversible connections for summer operation.

This system and the results obtained from it were described by Philip Sporn, vice-president and chief engineer of the American Gas & Electric Co., New York, and D. W. McLenegan, assistant engineer, air conditioning department, General Electric Company, in a paper entitled "An All Electric Heating, Cooling and Air Conditioning System." It is not felt that tests of the system as a summer air conditioner are necessary since it is a more or less conventional type when operating in the summer. The tests were run on the equipment when operated as a heating plant during February, 1935. The following table summarizes the performance data for the period indicated:

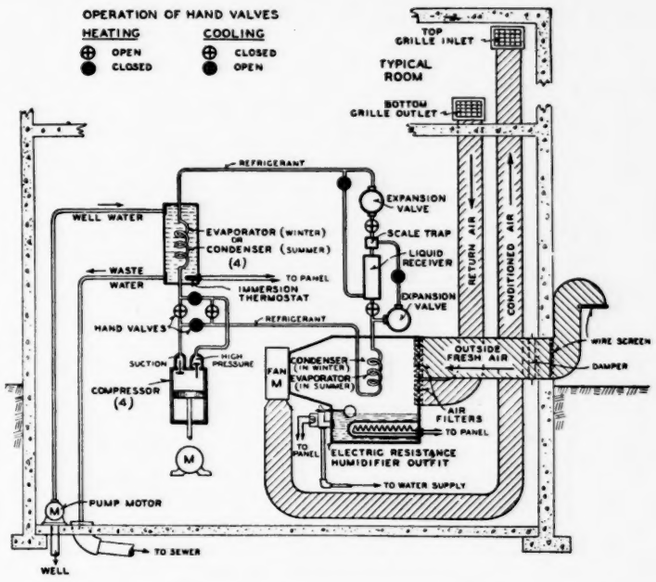
ACTUAL PERFORMANCE DATA ON SALEM HEAT PUMP
JANUARY 31 TO FEBRUARY 28, 1935

Outdoor Temperature	Deg.
High	55.
Low	10.
Average	34.5
Indoor Temperature	
High	78.
Low	56.
Average	70.
Incoming Water	Average 57.
Outgoing Water	Average 53.
Water Consumption	915,300 Gal.
Electric Consumption	Kw-hr.
Fan Motor, 2 hp.	582
Pump Motor, 3 hp.	1502
Humidifier	1503
Compressor, No. 1	2085
Compressor No. 2	1370
Compressor No. 3	1283
Compressor No. 4	1015
Total Metered	9475

From data obtained during the tests it is expected that the coefficient of performance under an average outside

temperature of 35° is approximately 3.3, as compared with a measured value of 3.51.

This paper excited quite a bit of comment, as was to be expected. Various questions brought out that the refrigerant used was Freon and that the costs are considerably above ordinary installations at the present time. In this installation the well water flow was held constant at 33 g.p.m. The subject of relative operating costs came up, regarding which the authors stated that this was a difficult question to answer inasmuch as electric rates are considerably higher than they would be if a number of these installations were made. Apparently, the authors believe that the heat pump can compete with a modern heating and air conditioning system when the electrical rate can be obtained for somewhat less than 1 cent per kw-hr.



Schematic layout of heat pump heating and cooling system in Salem, N. J.

Over a rather long period several members of the air conditioning department of General Electric Company have been attempting to develop a more scientific method of computing heat gain in air conditioning design work and their findings to date were summarized in an article entitled "A Rational Heat Gain Method for the Determination of Air Conditioning Cooling Loads." The authors were F. H. Faust, L. Levine, and F. O. Urban, all engineers at the Schenectady works of that company.

The authors state that the cooling load is composed of five different components made up of heat (1) conducted through walls and windows; (2) absorbed from sun radiation; (3) generated by lights and appliances; (4) brought in by ventilation air, and (5) that liberated by people. According to the authors, a complete heat gain calculation involves not only the independent calculation of each of the various components but also the proper combination of time to determine the particular hour at which the resultant load reaches its peak.

In connection with the heat gain through conduction, the authors developed a formula from which the outdoor temperature at a particular time of day can be computed. The formula is

$t_o = t_d - B V$ where

t_o = design outdoor temperature at a particular time of day.

t_d = design maximum outdoor temperature.

V = mean daily range for July.

B = an hourly factor, determined by the shape of the daily temperature curve.

A second formula for determining the total amount of heat conducted through a wall exposed to the sun follows:

$H_t = A_w U_w (t_o - t_i) + A_w R_w$

The first term on the right side of the equation is identical with the customary heat loss formula. The second term is:

$$H_r = A_w R_w$$

where

H_r = Additional heat conducted through a wall exposed to the sun, B.t.u. per hr.

$R_w = F a I$

I = Actual solar radiation striking the wall, B.t.u. per hr. per sq. ft.

a = Percentage (expressed as a decimal) of the incident solar radiation which is absorbed by the wall surface.

F = Percentage (expressed as a decimal) of the absorbed solar radiation which is transmitted to the inside.

A_w = Area of wall, window, etc., sq. ft.

H_c = Heat conducted through the wall, window, etc., B.t.u. per hr.

t_i = Design indoor temperature, °F.

t_o = Design outside temperature, °F.

U_w = Overall coefficient of heat transmission, B.t.u. per hr. per sq. ft. per °F.

In connection with combining the components to determine the maximum hour, the authors recommended the following procedure:

1. Calculate the maximum value which each component attains during the day, neglecting time lag.

2. Note the hours at which these peaks occur.

3. Consider time lag as reported elsewhere in the paper.

4. Select the proper time of maximum heat gain from an analysis of the above and

5. Where the economics of the application warrant the time required, make an hour-by-hour calculation of the heat gain.

In conclusion the authors summarized the salient features of their methods as follows:

1. It organizes and systematizes the work so that a complete and accurate calculation requires a minimum of both time and technical experience.

2. A new and simple method is presented for accurately calculating the sun effect through opaque walls and roofs.

3. The method of separating the components of the total load is such that the total sensible and total latent heat gains may be determined for any hour of the day.

4. An approximate method of allowing for time lag effects resulting from heat storage further improves the accuracy of the calculations.

5. A procedure is given for predetermining the time of day when the total heat gain is greatest.

6. The general procedure is applicable to an hour-by-hour calculation of the cooling load, if the economics of the application warrant it.

7. Although the discussion has been centered around the determination of the maximum total heat gain, it is equally adaptable to the determination for various conditions of operation, and may be used to determine the maximum ratio of dehumidification to sensible cooling.

A paper outlining the latest information available regarding the effect of registers and grilles on noise, resistance, volume, flow and appearance, in connection with air conditioning, was "Characteristics of Registers and Grilles" presented by J. H. Van Alsburg, engineer, Hart & Cooley Manufacturing Company. The author said that velocities up to 1500 f.p.m. can be used without air noise with practically any type of grille if a standard approach is used. A standard approach the author defined as a right angle term between the duct and the grille with a change in dimension so that the perimeter of the grille flange is larger than the perimeter of the duct so as to allow slower outlet velocity. He said that it is difficult to eliminate noise with a duct velocity of over 2000 ft., which would be necessary

if a velocity of 1500 ft. were recorded at the grille.

Messrs. Houghten, Gutberlet, and Trimble presented a research paper on "Air Supply to Classrooms in Relation to Vent Flue Openings." Information on this subject was requested by the Pennsylvania School Heating and Ventilation Commission which had debated the question of requiring vent openings in classrooms. The authors summarized their findings as follows:

1. The study, made in the 20 rooms of the Woodhaven School and in the 16 rooms of the Shaler School, indicates that, with normal unit ventilator operation and with all windows and doors closed, the closing of the vent opening decreased the volume of air delivery to the room by the unit ventilator from 1.7 to 25.9% of the delivery with the vent open. The average reduction in air delivery was found to be 10.5% for all rooms. This reduction in air delivery shows no consistent relationship with outside temperature, window area, or other room conditions, but seemed to depend more upon individual room characteristics.

2. The reduction in air delivery resulting from closed vents with low speed operation of the unit ventilators could be more than offset by an increase of the unit ventilator speed from low to intermediate.

3. Closing the vent openings usually resulted in a greater temperature gradient from the floor to the ceiling, and a higher temperature of approximately 1° at the ceiling. While the closing of the vent openings resulted in a slightly lower floor temperature for the same temperature at the 30-in. level, the drop in temperature was not great.

4. Closing the vent openings did not result in a greater temperature variation throughout the room at the 30-in. level in either an occupied or an unoccupied room, indicating equally good air distribution throughout the room with or without vent openings.

5. For the particular rooms studied in which all doors opened outward, no slamming or undesirable operation of the doors resulted from the pressure in the room when the vent openings were closed.

Another paper produced by the research staff, presented by Messrs. Houghten, Trimble, Gutberlet, and Lichtenfels, dealt with "Classroom Drafts in Relation to Entering Air Stream Temperature." In connection with this paper the authors pointed out that there is no accepted definition available explaining just what constitutes a draft.

An air conditioning installation in the fermenting room of an ale brewery was described by C. P. Creighton and F. J. Friedman, of McDougall & Friedman, consulting engineers of Montreal and New York. A particularly interesting feature of this installation was the ductwork. According to the authors:

"The ductwork presents several unusual features. Owing to the fact that the system had to be installed in an existing building, it was impossible to provide for the concealment of ducts. It was, therefore, necessary to run ducts on the ceilings of rooms over the top of fermenting tuns. It was considered that there was danger under certain conditions of ducts sweating and dripping into these open tuns with the possibility of contamination of the product. As the raw material is of considerable value and as such contamination might also cause great inconvenience, it was decided to build all such exposed ducts of insulating material. A composite material consisting of 2¼-in. layers of hard asbestos board with ½ in of wood fiber board between was chosen. These sheets were fastened together with galvanized angles, strips, and bolts. All main ducts, vertical and horizontal, were made large enough for a man to crawl through for cleaning. Vertical supply drops exposed in the room were constructed of polished no. 14 gage aluminum. Large vertical ducts were fitted with permanent steel ladders inside to aid in cleaning and vertical supply drops arranged so that a long handle brush could be pushed up from the bottom. Air distribution was controlled by numerous volume dampers rather than by duct sizes as the dimensions necessary for cleaning were often much larger than necessary for the quantity of air. In addition, duct sizes were chosen so that standard sheets of the insulating board could be cut without waste. The cost of this ductwork was about double that of sheet metal, though little if any greater than the cost of metal duct covered with insulating material."

A study of oil burners in residences in Madison, Wis., was made and recorded by Prof. D. W. Nelson, of the University of Wisconsin, who supervised the survey as a project of the Civil Works Administration. The paper, entitled "Oil Burning in Residences," was made in order to determine the efficiency of oil burning in actual installations. In addition, a laboratory study was made of an oil burner in a laboratory setup followed by the study of a performance of a burner in a residence. A study of the loss during all periods of oil burner operations in the laboratory indicated that a saving of 9% resulted from using a draft regulator to prevent air circulation through the combustion spaces of the burner during the off-periods. This saving was found when the burner was operated at about one-third load with the burner adjusted to run continuously when carrying full rating. Although not exactly the same, somewhat similar results were found in a residence.

Findings of the field survey covering some 140 residence installations indicated a stack loss of 27% as determined by a CO_2 average of 7.8% and an average flue gas temperature of 634°.

In a paper on "The Dust Problem in Air Conditioning" Prof. F. B. Rowley, of the University of Minnesota, gave particular attention to methods of measuring dust in air. In connection with his work he made some improvements in the viscous counter by means of which the orifice is moved relative to the viscous coated plate at a predetermined speed to distribute the dust sample over the field.

The so-called Chicago Standards for Certified Air Conditioning have already been described on these pages.[1] These standards have brought forth so much discussion that S. R. Lewis, consulting engineer, Chicago, was asked to summarize and comment on them.

In general, those discussing this paper seemed to agree that such engineering standards were necessary and the only differences with the standards that arose were those of detailed provisions. In his paper Mr. Lewis pointed out that the standards really related to minimum requirements. One discusser then mentioned that paragraph 15 (a) reading "Evaporator; pressure difference between inlet and outlet not to exceed one pound per sq. in." set up a maximum requirement inasmuch as the trend is now toward high pressure differences between inlet and outlet. Other comments included that on paragraph 18 relating to noise control and said that this should be related to the type of room being air conditioned. The permissible duct velocities called for in the standards were said to be far too conservative by several speakers. While one commentator said that in his experience instead of requiring a single foundation for the motor and fan, each should have a separate foundation to cut down noise. Whereas one or two speakers thought that setting up standards might cut down sales, a number defended the standards by saying that they would increase sales since the art is now in such a state that a number of building owners are afraid to install air conditioning because they are confused by the discrepancies between specifications proposed by various installers and manufacturers.

A paper by F. C. Houghten, H. H. Trimble, C. Gutberlet, and M. Lichtenfels, "Classroom Odors with Reduced Outside Air Supply," was also presented. An abstract of this will be found on page 56 of HEATING AND VENTILATING for June, 1935.

[1]See HEATING AND VENTILATING, April, 1935, page 34, "Engineering Provided for in Chicago Standards for Certified Air Conditioning."

INSIDE AND OUTSIDE DESIGN TEMPERATURES

(Summer and Winter)

The two tables on this side show the inside temperatures to be maintained for comfort—Table 1, for winter and Table 2, for summer.

Figures appearing in Table 1 are the winter temperatures maintained in various types of buildings. They are not necessarily design temperatures, although they can be so used. It is the custom in many cases to use 70° as the inside temperature for the purpose of estimating winter heat quantities and to disregard the maintained temperature. When it is realized that a 5° variation either upward or downward from 70° makes no more than a 5 to 7% difference in the usual estimates, it can be seen why it is fundamentally sound to use 70° for most ordinary cases. When this general practice is followed, values in Table 1 can be used for estimating special cases.

Table 2 shows the inside conditions to be maintained in buildings during the summer for various outdoor temperatures. Each set of values is in use to some extent as though they were design temperatures and, in the absence of any better information, such use is justified. Fundamentally, so far as is known at present, there is little to guide the user in making his choice among the four sets of values in the table. It is evident that all the figures are subject to the weakness that they are really not design figures at all but are operating figures based on experiments in one or two localities only. What little information is available points to the conclusion that inside comfort conditions are dependent among other things on locality with latitude an important factor. Certainly, experience indicates that people in New Orleans would not consider as comfortable the same summer temperatures which would satisfy Bostonians.

Table 3 on the other side of this sheet shows the outside summer and winter conditions for 96 cities throughout the United States. The first column in the winter section shows the lowest recorded temperature in that city, the second shows the design temperature used as reported by the readers of HEATING AND VENTILATING, while the third shows the average wind direction and velocity in miles per hour for the three winter months.

The summer section of the table gives the design wet and dry bulb temperatures and the wind velocity and direction. The fixing of the outside summer dry bulb for design purposes is troublesome because of the importance of also placing the wet bulb and of the lack of authentic simultaneous readings of wet and dry bulb temperatures in many localities. The values given in the table were collected from various sources and are believed to be the best in existence at present.

TABLE 1. INSIDE DRY BULB TEMPERATURES TO BE MAINTAINED FOR WINTER COMFORT

(Often used in written guarantees though not necessarily design temperatures. Temperatures measured at 5 ft. level—Humidity 40-60%)

SUB TEMPERATURE		NORMAL TEMPERATURE		HIGH TEMPERATURE	
Rooms where occupants are usually active, either at physical work or play		Rooms where occupants are usually sitting and conventionally clothed, at work or play		Rooms where patients are ill, unclothed, or sub-normally active	
	Degrees		Degrees		Degrees
Gymnasiums	55-65	Offices	68-72	Hospital rooms	70-80
Kitchens	65	Living rooms	68-72	Operating rooms	75-90
Playrooms	60-65	Classrooms	68-72	Bathrooms	70-80
Ballrooms	65-70	Theaters	68-72	Steam baths	110-120
Stores	65-70				
Factories—light	60-65				
Factories—heavy	50-60				

TABLE 2. INSIDE CONDITIONS TO BE MAINTAINED FOR SUMMER COMFORT

(For cities such as New York and Chicago, located at about 42° latitude)

Outside Dry Bulb	CONSTANT DEW-POINT—57°			CONSTANT R.H.—50%		EXPERIMENTAL METHOD—NO. 1			EXPERIMENTAL METHOD—NO. 2		
	Dry Bulb	Wet Bulb	Relative Humidity	Dry Bulb	Wet Bulb	Dry Bulb	Wet Bulb	Relative Humidity	Dry Bulb	Wet Bulb	Relative Humidity
100	—	—	—	82.5	69.0	—	—	—	82.5	66.0	42.0
95	80.0	65.0	45.0	81.0	67.7	81.0	66.0	45.0	80.0	65.0	44.0
90	78.0	64.5	47.0	79.5	66.5	78.5	66.0	51.0	77.5	64.0	43.0
85	76.5	64.0	50.0	78.1	65.3	77.0	65.0	52.0	75.0	63.0	51.0
80	75.0	63.5	51.0	76.7	64.0	76.5	65.0	54.0	75.0	63.0	51.0
75	73.5	63.0	53.0	75.3	63.0	74.5	64.0	57.0	—	—	—
70	72.0	62.5	60.0	74.0	62.0	73.0	63.0	59.0	—	—	—

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INSIDE AND OUTSIDE DESIGN TEMPERATURES

(Summer and Winter)

TABLE 3. OUTSIDE SUMMER AND WINTER CONDITIONS IN 96 CITIES

State and City	WINTER			SUMMER		
	Lowest Recorded Temp., °F.	Design[2] Temp. Actually Used, °F.	Average Wind-Vel. and Direction, m.p.h.	Design[2] Dry Bulb Temp., °F.	Design[2] Wet Bulb Temp., °F.	Average Wind-Vel. and Direction, m.p.h.
ALABAMA						
Birmingham	—10	10	8.6 N	93	77	5.2 S.
Mobile	—1	20	8.3 N	94	78	8.6 S W
Montgomery	—5	15				
ARKANSAS						
Fort Smith	—15	—15	8.0 E			
Little Rock	—12	0	9.9 N W	95	77	7.0 N E
CALIFORNIA						
Los Angeles	28	30	6.1 N E	88	70	6.0 S W
Sacramento	17	30				
San Francisco	27	30	7.5 N	85	68	11.0 S W
CONNECTICUT						
New Haven	—15	—5	9.3 N	88	74	7.3 S
DIST. OF COLUMBIA						
Washington	—15	0	7 3 N W	95	78	6.2 S
FLORIDA						
Jacksonville	10	27	8.2 N E	94	78	8.7 S.W
Pensacola	7	20				
GEORGIA						
Atlanta	—8	10	11.8 NW	91	75	7.3 N.W
Macon	7	10				
Savannah	8	20	8.3 NW	95	79	7.8 S.W
ILLINOIS						
Champaign	—25	—10				
Chicago	—23	—10	17 S W	95	75	10.2 N E
Rockford	—26	—10				
INDIANA						
Ft. Wayne	—24	—10				
Indianapolis	—25	—5	11.8 S	90	73	9.0 S W
Terre Haute	—18	—10				
IOWA						
Davenport	—27	—10				
Des Moines	—30	—15		92	74	6.6 S W
Sioux City	—35	—18	12.2 NW			
KANSAS						
Wichita	—25	—5		95	77	
Topeka	—25	—5				
KENTUCKY						
Louisville	—20	—5	9.3 S W	94	75	8.0 S W
LOUISIANA						
Baton Rouge	2	20				
New Orleans	7	25	9.6 N	94	79	7.0 S W
MARYLAND						
Baltimore	—7	0	7.2 N W	93	76	6.9 S W
MASSACHUSETTS						
Amherst	—22	0				
Boston	—18	0	11.7 W	88	73	9.2 S W
Fitchburg	—17	0				
Nantucket	—6	0				
MICHIGAN						
Detroit	—24	0	13.1 S W	93	73	10.3 S W
Saginaw	—23	0				
St. Joseph	—21	—10				
MINNESOTA						
Minneapolis	—33	—15	11.5 NW	84	72	8.4 S E
Rochester	—42	—20				
MISSOURI						
Kansas City	—22	—10		92	75	9.5 S
St. Louis	—22	—5	11.8 NW	95	78	9.4 S W
NEBRASKA						
Omaha	—32	—20		94	75	
NEW HAMPSHIRE						
Concord	—35	—10	6.0 NW			
NEW JERSEY						
Atlantic City	—9	0	10.6 NW			
Dover	—21	0				
Jersey City	—12	0				
Newark	—13	0				
Paterson	—13	0				
Trenton	—14	0		95	76	10.0 S W

State and City	WINTER			SUMMER		
	Lowest Recorded Temp., °F.	Design[2] Temp. Actually Used, °F.	Average Wind-Vel. and Direction, m.p.h.	Design[2] Dry Bulb Temp., °F.	Design[2] Wet Bulb Temp., °F.	Average Wind-Vel. and Direction, m.p.h.
NEW MEXICO						
Albuquerque	—10	0				
NEW YORK						
Albany	—24	—10	7.9 S	90	74	7.1 S
Binghamton	—28	—5				
Buffalo	—21	0	17.7 W	83	72	12.2 S W
Elmira	—24	—10				
New York	—14	0	17.1 NW	95	75	12.9 S W
Syracuse	—24	—2				
NORTH CAROLINA						
Greensboro	—2	20				
NORTH DAKOTA						
Bismarck	—45	—30	— N W	88	69	8.8 N W
Fargo	—48	—30				
OHIO						
Cincinnati	—17	—5		95	78	6.6 S W
Cleveland	—18	0	14.5 S W	95	73	9.9 S
Dayton	—16	0				
OKLAHOMA						
Oklahoma City	—17	5	12.0 N	96	76	10.1 S
OREGON						
Portland	—2	5	6.5 S	83	65	6.6 N W
PENNSYLVANIA						
Erie	—16	5				
Harrisburg	—14	0				
Lancaster	—27	0				
Philadelphia	—11	0	11.0 NW	95	78	9.7 S W
Pittsburgh	—20	0	13.7 NW	91	73	9.0 N W
Scranton	—19	—5				
Uniontown	—22	0				
York	—17	0				
RHODE ISLAND						
Providence	—17	0	14.6 NW	85	73	10.0 N W
SOUTH CAROLINA						
Charleston	7	20	11.0 N	94	80	9.9 S W
Columbia	—2	10	8.0 N E	100	78	
SOUTH DAKOTA						
Aberdeen	—46	—20				
TENNESSEE						
Chattanooga	—10	0		94	76	6.5 S W
Nashville	—13	0				
TEXAS						
Dallas	—10	10		99	76	9.4 S
Ft. Worth	—24	14	11.0 NW	95	75	
Houston	—5	20		93	79	7.7 S
San Antonio	4	20	8.2 N	100	78	7.4 S E
UTAH						
Salt Lake City	—20	0	4.9 S E	95	67	8.2 S E
VERMONT						
Burlington	—30	—10	12.9 S	85	71	8.9 S
VIRGINIA						
Lynchburg	—7	0	5.2 N W			
Richmond	—3	10	7.4 S	95	78	6.2 S W
WASHINGTON						
Seattle	3	10	9.1 S E	83	61	7.9 S
Spokane	—30	—10	5.2 S W	89	63	6.5 S W
Tacoma	7	10				
Walla Walla	—29	—10				
WEST VIRGINIA						
Wheeling	—25	0				
WISCONSIN						
Madison	—29	—15		89	73	8.1 S W
Milwaukee	—25	—17	11.7 W	93	74	10.4 S
Sheboygan	—38	—10				
WYOMING						
Laramie	—42	—10				
Sheridan	—45	—30	5.3 NW			

[1]As reported in publications of U. S. Dept. of Agriculture, Weather Bureau, covering long periods, 20 to 50 years, including winter of 1933-34. [2]As reported by readers of HEATING AND VENTILATING. [3]Collected from various published sources.

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EDITORIALS

Farewell to NRA

Enough time has passed since NRA received its knockout to permit intelligent comment on the situation which its sudden demise brought about. The decision brought bitter disappointment to some and was the cause of distinct rejoicing in other quarters. On the whole it looks as if the realities are being faced reasonably calmly both by those who were in favor of the law and those who opposed it. As yet the feared wage and hour reductions have not materialized to anything like the extent that those in favor of the codes predicted. Neither is there evidence that many of the abuses outlawed by the codes have reappeared dangerously. To many, including ourselves, it seemed at the time of the court decision that the following 30-day period would be the most critical, for it was known that there was strong feeling on both sides of the controversy and rash actions might easily follow any poorly advised moves on either side. Now that that period has passed without undue disturbance there is little likelihood that any immediate repercussions will be felt. There may be hurdles in the months ahead where some of the principles of high wages, fair prices and practices will be severely tested but there is every reason to believe that they will be taken in stride. Even within the 30-day period there are indications that the upswing of the business trend is continuing possibly stronger than before the decision put an end to what was rapidly wearing itself out anyway.

●

Watch Prefabrication for Equipment Developments

From time to time we have described some of the new prefabricated building constructions on these pages. We have been especially alert to watch for methods of heating or air conditioning which were different or which call for apparatus of unusual nature. We believe that every reader should attempt to keep in touch with these construction methods and these adaptations of equipment. This is true regardless of whether your work even touches buildings of detached residence type. If success crowns attempts to work out novel methods or apparatus for these special constructions you can be sure that the effects will be felt in all other building types. Just at present much development talent is working on the prefabricated idea for detached houses and the emphasis is all on low first cost. Low cost methods of heating, ventilating, or air conditioning are being sought for as never before. It is probable that finally the whole practice will settle down to a few accepted methods, and there is still a good chance that these methods will be the same ones used in the past. In the meantime one never knows what may turn up. Prefabrication offers possibilities of working decided innovations in heating practice. That's why it should be closely followed now.

●

Watch Apartment Work

The first five months of this year have shown a substantial increase (about 50%) in dollar volume of contracts let for residential construction. A rate of activity is indicated about on a level with the same period in 1932. In other words activity in this kind of work should be at the best level experienced for several years.

One trouble with such figures is that they do not indicate where the activity is within the several types of construction which go to make up what is so often called "residential" building. The usual tendency is to jump straight to the conclusion that what is meant is residences of the detached one- or two-family type. Analysis of the reported figures show that the dollar volume in these detached residences is only about 60% of the total. The other 40% is made up by apartment houses, hotels, dormitories, and housing developments. Still closer analysis brings out the point that the greatest percentage increase in activity between last year and this year is in apartment buildings. This is significant and in line with expectations but it would never be shown by a cursory glance at the overall figures.

This apartment increase is in line with our own predictions and with the suggestion repeatedly put forth on these pages in recent months. We have called attention of readers to what could be expected to happen in both the construction of new apartments and in the rehabilitation of old ones. We repeat now that there is every reason to believe that apartment work will hold up and continue for some time and that you should look there to be sure that your own plans are ready.

●

Licenses for Engineering Corporations

Word reaches us that the amendment to the New York State Engineer's Licensing Law forbidding formation of engineering corporations in the state is in effect. New corporations may not use or assume a name involving the words "engineer" or "engineering." Those previously organized and practicing engineering may continue to do so provided the chief executive officer and all employes carrying on engineering work are licensed professional engineers. All corporation employes who are designated as "engineers" must be licensed professional engineers.

Passage of this amendment strengthens the act to a great extent and closes up loopholes left in the earlier law. Just what is to be done about enforcement of all the provisions is not announced. Neither is it clear just how far the provisions really extend. There may be arguments about the wisdom of the whole thing but such an argument is not especially effective with the amendment already an accomplished fact. Compliance is to be preferred to defiance and it is probable that getting into line will not prove any great hardship. The amendment may be taken as illustrative of the kind of moves which are likely to be made in state after state to strengthen the licensing laws and put them in accord with the licensing restrictions surrounding other professional groups.

●

Amortized Mortgages for New Construction

We have repeatedly remarked the growing popularity of the fully amortized mortgage as a means of financing. This mortgage is well tested having been in use by building and loan associations for years. Not only are these associations continuing to use this plan but now savings banks and insurance companies are showing more interest in it. They are advertising it and talking up its advantages. Much of the new financing is taking this form, with and without the insurance feature. It looks as if it will shortly be the only active form of mortgage financing for new building construction, for it is hard to see how any other can successfully compete against its obvious advantages. Sound mortgage plans are absolutely essential to our business progress. Help promote and spread acceptance of the amortized mortgage for both renewals and new construction.

ABSTRACTS of Current Papers, Books and Pamphlets

Estimating Tables for Forced Air Heating

This book should be of interest to all those who design and install forced air heating and winter air conditioning systems in residences and other small buildings. Essentially, this book is devoted to the subject of figuring air requirements and of sizing duct systems for forced air heating systems.

The book consists mainly of tables so designed that they can be applied easily to the design of such systems. A careful study of the tables and the examples given should enable the reader to quickly estimate the cubic feet of air per minute required, the areas of registers, the dimensions of risers and ducts, and the heat losses for any residence or small structure using a system of forced air circulation.

[*"Jones' Estimating Tables," by E. F. Jones. Published by Domestic Engineering Publications, 1900 Prairie Ave., Chicago. Imitation leather binding; 5¾ x 8¾ in.; 68 pages; price, $2.*]

●

Arc Welding Manual

Welding is daily becoming of more and more importance to workers in the heating and ventilating industry, especially in modernizing work. This book has been written in order to acquaint the beginner with the advantages of arc welding as well as to explain the newest technical information to the more experienced worker.

A previous edition of the book appeared in 1930 but there have been so many developments in arc welding methods and applications as well as equipment, that it was necessary to publish a completely revised edition. A special effort has been made to present the facts in a non-technical manner so that they will be as useful to the beginner as to the experienced operator or technician. A large number of pictures are used to illustrate the text.

Among the subjects covered are the welding arc, welding equipment, weldability of metals, types of joints and welds, strength of welds, speed and cost of welding, using the metallic arc, welding with bare electrodes, and welding with coated electrodes.

[*"Electric Arc Welding Manual"—Second Edition, by W. J. Chaffee; published by The Hobart Brothers Co., Box EW—46, Troy, Ohio. Fabricoid binding; 5½ x 8 in.; 96 pages; price, $1.*]

●

Excluding Solar Heat From Buildings

It is often quite a difficult problem during the summer months to keep the temperature in single-story factory buildings low enough to enable men to perform heavy manual labor in reasonable comfort. In such buildings the roofs and often the walls are made up of light steel frames covered with sheets of galvanized iron or asbestos alternating with large areas of glass. Except where north lighting is used, a large portion of the heat gain is likely to occur through the roof lights.

Glass is very transparent to solar radiation, some commercial forms transmitting as high a proportion as 85%. It is, however, almost completely opaque to low temperature radiations from bodies at ordinary room temperatures. A window, therefore, acts as a heat valve, letting in the radiant heat easily but refusing exit to the radiation from the surfaces warmed by the sunshine.

THE EFFICACIES OF VARIOUS THIN STRUCTURES IN EXCLUDING SOLAR HEAT.

Structure	Surfaces Upper/lower	Relative Temperature Excess
Glass	Clear/clear	100
,,	Clear/whitewash (1 coat)	61
,, white calico 1 in. below	Clear/clear	57
,,	Green distemper (1 coat)/clear	55
,,	Whitewash (1 coat)/clear	49
,,	Clear/whitewash (2 coats)	46
,, white calico 1 in. above	Clear/clear	40
,,	Whitewash (2 coats)/clear	28
Metal sheet	Black paint/black paint	42
,, ,,	Black paint/aluminium paint	36
2 metal sheets with 1 in. unventilated air-space	Black paint/black paint Black paint/black paint	33
Galvanised-iron, corrugations N.-S.	Untreated	29
Asbestos-cement—flat sheet	Untreated	24
2 metal sheets with 1 in. ventilated air-space	Black paint/black paint Black paint/black paint	23
Wallboard (½ in.) between metal sheets	Black paint//tinplate Tinplate/white paint	19 17
Metal sheet	Black paint//tinplate	14
Wallboard (1 in.) between metal sheets	White paint/aluminium paint	8
Metal sheet	Tinplate/tinplate	6
,, ,,	White paint/tinplate	0
2 metal sheets with 1 in. unventilated air-space	White paint/tinplate Tinplate/tinplate	−1
2 metal sheets with 1 in. ventilated air-space	White paint/tinplate Tinplate/tinplate	−3

The only way to prevent this heat from entering is to use some form of screen, light in color to reflect the sun's rays but sufficiently translucent so as not to interfere too seriously with the natural lighting of the building. White blinds and the whitewashing of the roof lights are methods commonly adopted for this purpose.

The efficacies of various treatments have been tested at the British Building Research Station and the results listed in the table above. In order to associate the measurements made on different days, the amount by which the maximum temperature under the glass exceeded the maximum air temperature for the day has in each case been expressed as a percentage of the corresponding excess beneath the clear glass. The resulting relative temperature excess for each method of treatment is shown in the above table.

The second half of the table shows the effect of treating the metal roof with different materials. The relative temperature excess is in each case also expressed as a percentage of the corresponding excess beneath the clear glass.

[*"The Exclusion of Solar Heat—Light Roofing Structures," by H. E. Beckett. Published in the Journal of the Institution of Heating and Ventilating Engineers, London, December, 1934; pages 461-464.*]

●

Estimating Radiator Surface

There are in existence today a large number of methods of determining the amount of radiator surface to be placed in a room. Naturally, each method has some advantages and disadvantages not possessed by the others.

In order to help in the selection of a method, the author has gathered together in one book six standard and recognized ways of determining radiator surface and has explained the advantages and disadvantages of each.

(Concluded on page 79)

EDITOR'S NOTE—Brief reviews of most of the technical papers presented before the summer meeting of the American Society of Heating and Ventilating Engineers last month appear in the report of that meeting beginning on page 56.

NEWS OF THE MONTH

Gas Utility to Erect Model Homes

BOSTON — Ground was broken June 15 on sites in Brookline, Newton, and Wellesley, for three model fully gas-equipped houses, to be constructed in cooperation with the Boston Consolidated Gas Company by Homer T. Brown, a Brookline realtor. Officials of the towns, of the gas company, and of the Federal Housing Administration participated in the ceremonies.

One of the three houses, in addition to automatic gas heat, an insulated gas range of the latest type, gas refrigerator, and self-acting water heater, will be gas air conditioned. The other two will have all the latest gas appliances named above except air conditioning.

Two of the most elaborate homes will sell at over $17,000 and around $13,000, in the Chestnut Hill Golf Club development and the Stony Brae Estates at Newton Highlands, respectively. The third house, in the $10,000 class, will be built at the Abbott Estates, Wellesley.

Association Pushes Sale of Lignite

DENVER — A concerted nine-month campaign to promote the use of lignite coal for house-heating has been launched by the Northern Colorado Coals, Inc., an association of northern Colorado coal operators formed several months ago and patterned after Appalachian Coals, Inc.

The association is seeking to increase the use of lignite coal by educating the public to the advantages of automatic coal heat and coordinating the diverse and often conflicting interests in the coal heating field.

A research department has been set up in a downtown office to handle all inquiries resulting from the advertisements, to conduct research into the most efficient methods of air conditioning with the use of coal heat; to furnish heating information, and to maintain close contacts with stoker and air conditioning dealers, builders, contractors, and architects.

Expenses of the campaign are being met by a tonnage assessment on members of the association, which represents 95% of the tonnage in the northern Colorado lignite field.

Graham New Dean at Kentucky

LEXINGTON, KY.—Col. James Hiram Graham of Louisville was appointed May 29 dean of the College of Engineering at the University of Kentucky. He fills the vacancy caused by the death April 8, 1934, of Dean F. Paul Anderson.

Hold Meeting on A.C. Standards

CHICAGO—A meeting of importance to the air conditioning industry in Chicago was held on June 14 in the offices of John Howatt, chief engineer of the Board of Education, in the Builders' Building.

Its purpose was to revise air conditioning standards which have already been established and to define in more detail the requirements of air conditioning installations.

The meeting brought together representatives of the various societies and organizations. The following men attended the meeting and formed a permanent organization:

S. C. Bloom, American Society of Refrigerating Engineers;

R. B. Hayward, Chicago Ventilating Contractors' Association;

H. M. Hart, Chicago Master Steamfitters Association;

E. B. M'Clellan, National Electric Manufacturers Association;

R. E. Hattis, Illinois Chapter, American Society of Heating and Ventilating Engineers;

S. R. Lewis, Western Society of Engineers;

E. T. Murphy, Refrigerating Machinery Association;

John Howatt, chief engineer, Chicago Board of Education;

John J. Davey, Illinois Society of Architects;

Frank Erlenborn, Building Managers Association.

The following officers of the permanent committee were elected: John Howatt, permanent chairman; S. R. Lewis, secretary, and H. M. Hart, treasurer. The committee is to be known as the "Chicago Committee on Air Conditioning Standards."

Newark Has 23 A.C. Systems

NEWARK—There were eight air conditioning installations made in this city during 1934 and added to the lines of the Public Service Electric & Gas Company, according to J. P. Leinroth, general industrial fuel representative of that utility. The figures do not include installations on the lines of the company in other districts.

A tabulation of the installations follows:

TYPE OF ESTABLISHMENT	PRIOR TO 1934		1934		TOTAL	
	No.	HP.	No.	HP.	No.	HP.
Theaters	4	990	—	—	4	990
Hotels	1	11	—	—	1	11
Banks	1	137½	—	—	1	137½
Offices	6	165¾	3	7¾	9	173½
Restaurants	2	127¾	—	—	2	127¾
Stores	1	80	2	91¼	3	171¼
Mortuaries	—	—	2	17	2	17
Miscellaneous	—	—	1	2	1	2
TOTAL	15	1512	8	118	23	1630

St. Louis Group Meets

ST. LOUIS—The St. Louis chapter of the ASHVE held a dinner-dance at the Norwood Hills Country Club June 8. This was the final activity before the summer vacation. About 90 members and guests attended the party which was arranged by a committee consisting of E. E. Carlson, D. J. Fagin, J. E. Manahan, and L. R. Szombathy.

Free Course in A.C.

CHICAGO — The Chicago chapter of the Federation of Architects, Engineers, Chemists and Technicians is starting its second course in Air Conditioning. This four-week course is presented by J. H. Scheyer. Subjects to be dealt with are the practical applications of air conditioning, and uses of the psychrometric chart.

Meetings will be held on Tuesdays and Thursdays. Classes will be conducted from July 2 to July 30, inclusive, 7 to 9 p.m. No fee is charged. Persons interested in air conditioning are cordially invited to attend.

Headquarters of the federation is at 160 North Wells St., room 317, Chicago.

New A. C. Firms in Jersey

NEWARK—There has been a noticeable increase in Essex County in the formation of new concerns in the air conditioning and oil burner field.

Challenger Heating & Engineering Co., 778 Mt. Prospect Ave., Newark, has been formed by Charles Eldridge to install and service oil burners and heating equipment.

The Montclair Air Conditioning Co., 605 Valley Road, Upper Montclair, has been organized by Luther McG. Moyer, Raymond Daly, James Timson, and Joseph J. Hooton, to sell and deal in air conditioning and accessories and to carry on business of air conditioning engineers.

Louis C. Larsen heads the New Jersey Air Conditioning & Heating Co., 55 Central Ave., Orange.

Wilson Maintenance Service, repairing oil burners, has started business at 47 Elm Road, Caldwell. Orval W. Wilson is owner.

A section of the Air Conditioning Show held in Newark June 3-8

New Jersey A.C. Show

NEWARK, N. J.—The second air conditioning show sponsored by the Public Service Electric and Gas Company in cooperation with the manufacturers and distributors of summer and winter air conditioning equipment took place here from June 3-8, inclusive. It was extremely well attended by homeowners, store owners, architects and builders, professional men, executives and heating and plumbing contractors. There seemed to be particular interest in the air conditioned rooms which consisted of an executive's office, a dental office, a lecture hall in which a film on air conditioning was shown, a dining room, a living room, and a restaurant. All of the rooms were temporary exhibits.

One of the unusual exhibits which attracted much attention was the new gas fired summer air conditioning system which uses silica gel to remove the moisture on hot humid days instead of doing it with the customary method of mechanical refrigeration.

Exhibits of heat conservation materials such as insulation, storm sash, and weatherstripping were a'so shown. These exhibits created considerable interest and demonstrated that a homeowner today is very much interested in cutting his operating costs for heating by this method and also improving his living conditions in the summer time by keeping out the heat.

There were a great many visitors from New York, Long Island, New England, and Philadelphia.

H. & V. Show 81% Sold

NEW YORK—One hundred and twelve firms have made arrangements for 191 spaces at the International Heating and Ventilating Exposition to be held in Chicago next winter, according to Charles F. Roth, manager of the exposition. This accounts for 81% of the space available at the show.

Five Chain Restaurants Start A.C. Plants

CHICAGO—Five more restaurants of the Pixley & Ehlers system switched on their newly installed air conditioning plants June 15, according to P. D. Horgan, air conditioning editor of the *Chicago American*.

This brings to 10 the number of establishments so equipped in the 13-unit chain.

Installation of air conditioning in the final three restaurants is to be started within a few days to make the chain the first completely air conditioned one in Chicago.

"The greatly increased efficiency of our employes and the physical comfort afforded our patrons in the five restaurants we equipped last year decided us on air conditioning our entire system," Mr. Pixley said.

The air conditioned restaurant, Mr. Pixley pointed out, is a strong factor in the patron's general health. The common tendency to eat and drink only cold foods and liquids during the hot weather is not the best practice, according to physicians.

A cool eating place, on the other hand, is conducive to eating the warm meals necessary to good physical condition.

Mackie Appointed A.C. Sales Manager

TORONTO, ONT.—F. W. Chambers & Company, air conditioning engineer, 992 Bay Street, who recently opened new and larger offices at the above address, has appointed John H. Mackie as manager of sales.

Mr. Mackie, who has had several years experience as a sales agent for some of the larger pulp and paper mills of Canada and the United States, comes to the position with every qualification.

"Dictator" for Hard Coal Industry

SCRANTON, PA.—Mine operators in the anthracite industry, acting through the Anthracite Institute, have appointed a "dictator" to coordinate and regulate the industry. C. F. Huber, of Wilkes-Barre, Pa., chairman of the board of directors of the Glen Alden Coal Company, was selected for this post. He will have charge of machinery concerned with problems of production, market prices, rebates, recounts, sizings, and other aspects of the hard coal mining industry in an effort to eliminate unfair practices and help maintain the industry on a stable basis.

There is no connection, anthracite producers said, between this move in their industry and the recent decision of the Supreme Court invalidating the NRA. The anthracite industry has never had a code under the NRA, so that the court's decision has not affected plans for the adoption of fair trade practice rules, which have been discussed in the industry for months.

The Anthracite Institute issued the following statement here concerning its plans:

"The anthracite industry, in an effort to cure some of the ills resulting from unfair trade practices, and to restore confidence among producers, distributors, and those they serve, is contemplating the adoption of a voluntary plan with these objectives.

"Whi'e the plan has not yet been formulated, it can be definitely stated that it does not contemplate any control or fixing of prices.

"For the administration of the plan when formulated, the industry has enlisted the services of C. F. Huber, of Wilkes-Barre, Pa.

Gas Heating Rates Cut

TRENTON, N. J.—A move to promote use of gas for heating is behind the revised schedules filed in Trenton June 12 by the Public Service Electric and Gas Company. The State Public Utility Commission has announced the new rates will result in an annual saving of $450,000 to users of residential service exceeding 5,000 cu. ft., and $400,000 to wholesale users.

The reduction will be effective July 1 for wholesale, and October 1 for residential consumers. The action, the company said, was taken to stimulate business and stay continuing losses.

The board stated that investigation showed the decline in revenue was due to falling off in use of gas in competition with coal, coke, and oil. The lowered income threatened ability to maintain residential rates at their present level. The rate reductions to large consumers were finally agreed upon to stimulate use of gas as fuel.

Clothing Store Air Conditioned

BOSTON—Unique in a number of respects is the air conditioning job just finished at the store of Crawford Clothes in this city, the first strictly clothing store in New England to be conditioned. The installation presented a number of difficulties which were successfully overcome by H. Bentam, the Crawford Company's engineer, who recently installed air conditioning systems in four other Crawford stores, in New York, Philadelphia, Newark, and Jamaica, L. I.

In Boston the store is long and narrow, with a corner entrance, which precluded any direct draft from the street. Two air conditioning units were required to take care of the store and the basement. The ducts also had to be smaller than usual in order to save space, which is at a premium in the store.

A 5-hp. methyl-chloride compressor serves the store while a 3-hp. unit is used to cool the basement. Eight glass filters are used to clean the air for the store and eight for the air in the basement tailor shop. The filters are arranged in double banks of four each, those for the store being placed in a galvanized enclosed closet, while those for the basement and tailor shop are overhead in the duct.

Fresh air is drawn from the street level and brought down over the cooling coils and then recirculated, the ratio being three to one.

Air can also be circulated by means of the blower alone, thus saving power when outside temperature is cool.

Gas Appliances Approved

TORONTO, ONT. — The Canadian Gas Association has announced its new list of gas appliances to be approved in the Association's laboratory. The products of nineteen firms have been given approval. The United States firms listed are American Gas Products Corp., New York; Hotstream Heater Co., Cleveland; Beach Foundry, Ottawa; Ever-Hot Heater Division of Truscon Steel Co. of Canada, Walkerville, Ont.

Airtemp A.C. for Railroads

NEW YORK—Airtemp, Inc., distributor for air conditioning products of Chrysler Motors, will furnish air conditioning equipment for 11 dining cars on the New York Central Railroad and four dining cars for the Pennsylvania Railroad, it was announced early in June. The Airtemp units to be installed in the dining cars of the two railroads will provide for heating in the winter as well as cooling during the summer.

Faulty Heating Causes Ear and Nose Troubles

NEW HAVEN, CONN. — Air conditioning may join cosmetics and facial massage as a beauty aid if the suggestions of Dr. Leon Feldman, noted Philadelphia oto-laryngologist, are followed.

In an address before the ear, nose and throat section of the Connecticut State Medical Society at Yale University here May 23, the doctor stated that faulty heating is chiefly responsible for the fact that the inhabitants of America are "growing to be a race having bigger but not better noses."

Air conditioning is needed both in homes and places of employment if the development of oversized nasal equipment is to be checked, Doctor Feldman said, adding that "savages of darkest Africa live in greater security and comfort than the best civilized citizenry of today. More than 75% of the infectious diseases of the ear, nose and throat, having an allergic tendency, result from our faulty heating system."

Northern New Jersey A.C. Jobs Up 60%

NEWARK, N. J.—Steady and rapid growth in summer air conditioning in Northern New Jersey is indicated in a survey of the industry in this area just completed by the Public Service Gas and Electric Company.

The survey showed 123 air cooling units utilizing electrical refrigeration in the territory and an increase of 60% in number of units installed in the first five months of this year as against last. Included in the list of installations were banks, stores, business offices, restaurants, beauty parlors, movie theaters, bowling alleys, and private residences.

New Orleans Adds 33 A.C. Jobs

NEW ORLEANS—There are now 85 air conditioning installations in this city, according to G. E. May, utilization engineer, New Orleans Public Service Inc. Of these, 33 were made during 1934.

These installations are summarized in table following:

TYPE OF ESTABLISHMENT	PRIOR TO 1934		1934		TOTAL	
	No.	Hp.	No.	Hp.	No.	Hp.
Offices	10	57	5	53	15	110
Restaurants	—	—	5	170¼	5	170¼
Industrial	11	113½	2	109½	13	223
Residences	13	28	11	31½	24	59½
Hotels	1	103	1	4	2	107
Hospitals	—	—	3	11½	3	11½
Theaters	4	1442	—	—	4	1442
Banks and brokerage	2	526½	—	—	2	526½
Stores[1]	11	1996	6	126	17	2122
TOTAL	52	4266	33	505¾	85	4771¾

[1]Includes 2 radio studio installations.

A.C. for Hospital

CHICAGO—The Evangelical Hospital here has equipped a large room with air conditioning for the treatment of hay fever, pneumonia, and asthma. The temperature and humidity are controlled, the air being cooled and dehumidified in summer as well as heated and humidified in winter. An ozone generator is also installed.

The installation was made following research work by E. W. Riesbeck, Chicago engineer and author.

Voorhees Elected by A.I.A.

MILWAUKEE — Stephen F. Voorhees of New York, chairman of the Construction Industry code authority, was elected president of the American Institute of Architects at the 67th annual convention of that organization held here May 28-31.

Mr. Voorhees is a member of the durable goods industries committee, of the executive committee for the Construction League of the United States, and of the Housing Advisory Council of the Federal Housing Administration. He is a member of the firm of Voorhees, Gmelin & Walker, New York, which has designed many notable buildings including the New York Telephone Building, the Western Union Telegraph Building, the One Wall Street Building, and the Headquarters Building for the New Jersey Telephone Co., Newark, N. J.

He is the supervising architect of Princeton University. He is now director of the institute for the New York division; chairman of the advisory board on vocational and industrial education of the New York Board of Education, and president of the Apprenticeship Commission of the New York Building Congress.

Mr. Voorhees was born in Rocky Hill, N. J., in 1878. He attended the State Model School at Trenton, and graduated in civil engineering from Princeton in 1900. He served in the Spanish American War as corporal, and was captain and major in the sanitary corps of the U. S. Army from 1917 to 1919.

He is a member of the American Society of Civil Engineers, ASME, Princeton Architectural Association, Princeton Engineering Association, and Architectural League of New York.

O.B. Men Consider Greenhouse Market

BOSTON—At the final meeting of the Boston Oil Burner Associates, before adjournment until the middle of December, one of the guest speakers was H. O. Tappan, representative of Lord & Burnham, specialists for 72 years in the construction and heating of greenhouses.

Mr. Tappan dealt with the subject of heating greenhouses from the standpoint of oil burner firing, after briefly sketching the history of greenhouse heating methods. While conceding that oil burners have a chance in this field, he warned that they had to compete with very cheap fuel—coal at an average of six to eight dollars per ton for the grades used.

He stated that some successful commercial greenhouse plants had dual plants—oil fired boilers and coal boilers, each with 75% of the necessary heating capacity and so arranged that the grower could switch from one to the other in case of breakdown, such as failure of the overhead electric lines connected with the oil burner plant, or could supplement one with the other in case of excessive cold, or shut down one according to the fuel market.

He declared that to date there is no dependable engineering data on greenhouse heating available, such as operating and maintenance costs, including heating, and that the oil burner man must proceed cautiously in making his survey and estimates.

Greenhouse temperatures also differ greatly from house or commercial plant temperatures, ranging from a low of 35° to 75° maximum and an average range of 55° to 60°. Therefore thermostats with special ranges should be used. There is not only the heat loss from the great area of flat glass, but also from the cracks between the overlaps, which often are as much as a half inch. But with seven years of neglect in upkeep of greenhouses everywhere, he said the field is wide open to oil burner men who can deliver one or two satisfactory jobs to the larger and more influential growers.

Electrical Show to Feature A.C.

CAMDEN, N. J.—Domestic and commercial air conditioning equipment will be one of the big features of the Second South Jersey Electrical Show to be held September 25-28, inclusive, in Camden Convention Hall and Annex. Approximately $500,000 worth of the most modern electrical appliance and equipment will be presented for the first time to the public.

The show will be staged under the direction of the Electrical League of South Jersey. Frank S. Horning is president of the league and general chairman of the show committee.

A.C. House Built in Washington

WASHINGTON—The new E. V. Pugh Company houses have received wide approval here. The company recently announced the first completely air conditioned house to be offered at less than $6,000.

The location is on Fourteenth Street, in Waycroft, Va. In the same block are five other houses without air conditioning, but all with special features, containing four, five, and six rooms and priced from $6,400 to $7,200.

In the air conditioned offering, automatic heat in the winter, cooling in the summer and filtered, conditioned and circulated air throughout the year come through the same unit designed for this house by American Radiator Company.

Bauer Handles Frigidaire

HARTFORD, CONN.—Bauer & Co., Inc., 440 Asylum Street, has been appointed sales and service representative for Frigidaire air conditioning equipment. The firm has been handling the Frigidaire domestic refrigeration line for some time.

Associate dealers in Hartford include Tychsen & Co., 100 Allyn Street, and the Perry Electric Co., 442 New Britain Avenue.

Stoker Company Expands

TORONTO — The Iron Fireman Mfg. Company of Canada, 602 King St., W., maker of automatic coal burners, has acquired an additional 11,000 square feet of floor space. The firm is now occupying five times the space it had when factory operations started here five years ago.

Plans Drawn for Central Heating Plant

SKOWHEGAN, ME.—A central heating plant, to cost $65,000, is to be erected here at the State Reformatory for Women. Plans, which include a laundry, will be ready about the middle of July at the Public Institutions Department, State House, Augusta. A. J. Thayer Co., 2 Spring St. Extension, Auburn, Me., is the engineer.

Central Heating Plant to be Erected

BANGOR, ME. — A central heating plant is to be constructed at the Maine State Hospital, this city, to cost $35,000. Plans will be ready in the fall. The engineer is the Fels Co., 42 Union St., Portland, Me., and the construction will be under the direction of Dr. H. C. Hanson, Public Institutions Department, State House, Augusta.

Ontario Chapter Elects

TORONTO—One of the features of the final meeting of the local chapter of the ASHVE for the year, held recently in the Royal York Hotel, was the election of officers. The meeting was attended by about forty members.

M. W. Shears was elected president and Tom McDonald vice-president. H. R. Roth was reelected secretary-treasurer, while H. D. Henion, G. A. Playfair, and Hugh B. Jenney, were elected to the board of governors.

Lehigh Honors Carrier

BETHLEHEM, PA.—Willis H. Carrier received the honorary degree of Doctor of Engineering at the commencement exercises of Lehigh University June 11 when 259 degrees in course were conferred.

Aubrey Weymouth, who has supervised the erection of many New York skyscrapers was similarly honored.

Buys Century Dealer Interest

NEW YORK—James E. Beckley, of New York, and John A. Pratt, Montvale, N. J., have purchased the interests of Messrs. Mericle and Pollock in the Century Products Co., New York, distributor of Century oil burners, boiler-burner units, and humidifiers for greater New York.

Mr. Beckley was formerly vice-president and treasurer of Electrographic Corporation, while Mr. Pratt has been a Century dealer for over five years.

Perkins & Colter Appoints Duncan

BOSTON—Perkins & Colter Company, heating specialties, 61 Oliver Street, this city, announces that George T. Duncan, 99 Fort Hale Rd., New Haven, Conn., is representing its firm in Connecticut and western Massachusetts in the sale of Taco Trol hot water heating systems, manufactured by Taco Heaters, Inc., and in the sale of Dole air valves in western Massachusetts and eastern Connecticut.

Burner Committee Meets

NEW YORK—The executive committee of the American Oil Burner Association held a meeting at the Pennsylvania Hotel June 12-13. No details of the committee's deliberations have been disclosed other than a statement by W. J. Smith, president of AOBA, that a materially enlarged and comprehensive program would be submitted to the board of directors at its next meeting which will be held at Cleveland on July 9.

Knisely Talks on "High Hat Steels"

NEW YORK—"High Hat Steels and How to Sell Them" was the title of an address delivered before the Iron and Steel Group of the National Association of Purchasing Agents, May 22, at the Waldorf-Astoria Hotel, by S. A. Knisely, advertising and sales promotion manager, Republic Steel Corp., Youngstown.

Mr. Knisely traced briefly the development of modern special steels, or "high hat steels," as he termed them, and pointed out that these steels have been produced to satisfy the demands of the purchasing agent and his technical consultants. He also brought out the fact that the old-fashioned type of "hard-boiled" purchasing agent has been replaced with a new type—the purchasing agent with an open mind and a willingness to listen to intelligent presentations of facts.

Mr. Knisely explained how Republic is training its salesmen to be of maximum assistance to purchasing agents. The company conducts a modern school, training salesmen for 1940. According to the speaker, while the school is relatively small and requirements limited, the number of applicants is large, being in excess of 300 at the present time. Competition for enlistment is exceptionally keen. Applicants are college graduated, many with a technical education and some with masters' degrees.

Applicants are chosen by a board of five, composed of the vice-president in charge of sales, general sales manager, assistant general sales manager, sales promotion manager and assistant sales promotion manager. Those chosen are not immediately placed in the school but must serve a probationary period of six months in the general offices.

If at the end of six months the applicant measures up to the standards he is placed in the school and begins an observational course of about 57 weeks in the mills. He spends sufficient time in each department to become thoroughly familiar with the operations. He must prepare a report on each department, which is graded by the superintendent and by the sales promotion department. Students attend night classes once a week and listen to lectures by both operating and sales executives. They are given training in public speaking and are taught to stand on their feet and sell their wares. They are instructed in the art of business letter writing, are acquainted with the problems they are likely to meet in the field and how to solve them. During this time they are paid a modest salary.

After they have completed the course in the mills they are sent to the district offices as sales promotion men.

James New ASHVE Technical Secretary

NEW YORK — The ASHVE has appointed John W. James technical secretary to handle the engineering phases of its various activities. He will be located at the society's headquarters in New York.

John W. James, new ASHVE technical secretary.

A graduate of Oregon State College with the degree of B.S. M.E. in 1928, Mr. James was engaged as test engineer in the air conditioning division of General Electric Company, as research engineer in the department of mechanical engineering, University of Wisconsin, and in the design of mechanical systems for public and private buildings for G. E. Reed, consulting engineer, Portland, Ore.

Study Rural Market for Heating

TORONTO—Opportunities in the rural market in Ontario for heating appliances have been investigated by the Canadian Institute of Plumbing and Heating and a report issued. The report reveals that there is a large field available for live heating contractors who will give attention to the modernization and equipping of farm homes in the more prosperous rural sections of the province.

Utility Sells Gas Heat and Roof Insulation

BALTIMORE—The gas heating sales department of the gas and electric company of this city is making a special combination offer in order to promote the installation of gas-burning heating equipment. The combination involves roof insulation as well as the installation of gas heating equipment. The offer is based on a time payment plan.

Mason Reenters District Heating Field

NEW YORK — Friends and acquaintances of Gilmore Mason will be pleased to learn of his reentry into the field of district heating. Mr. Mason will be remembered because of his development of the Mason condensation meter and also because of his long connection with district heating, running back over 30 years. In its earliest days he spent some eight or nine years with the Baltimore district heating company and was later with the New York Steam Corporation for a period of 17 years.

Mr. Mason is associated with Lyle A. Hall, with whom he has organized a partnership and established offices at 32 West 46th Street here. The new company proposes to develop and present a line of devices of especial interest to operators of plants where district heating is used. The newest product consists of a steam control device which is of simple construction and which is expected to reach the market at a low first cost. Adjustment is said to be simple, flexible, and responsive. A control which actuates a balanced valve in the steam supply line receives its energy from water power and through a clock device. It operates through a time cycle which is capable of adjustment.

Baker Addresses Contractors

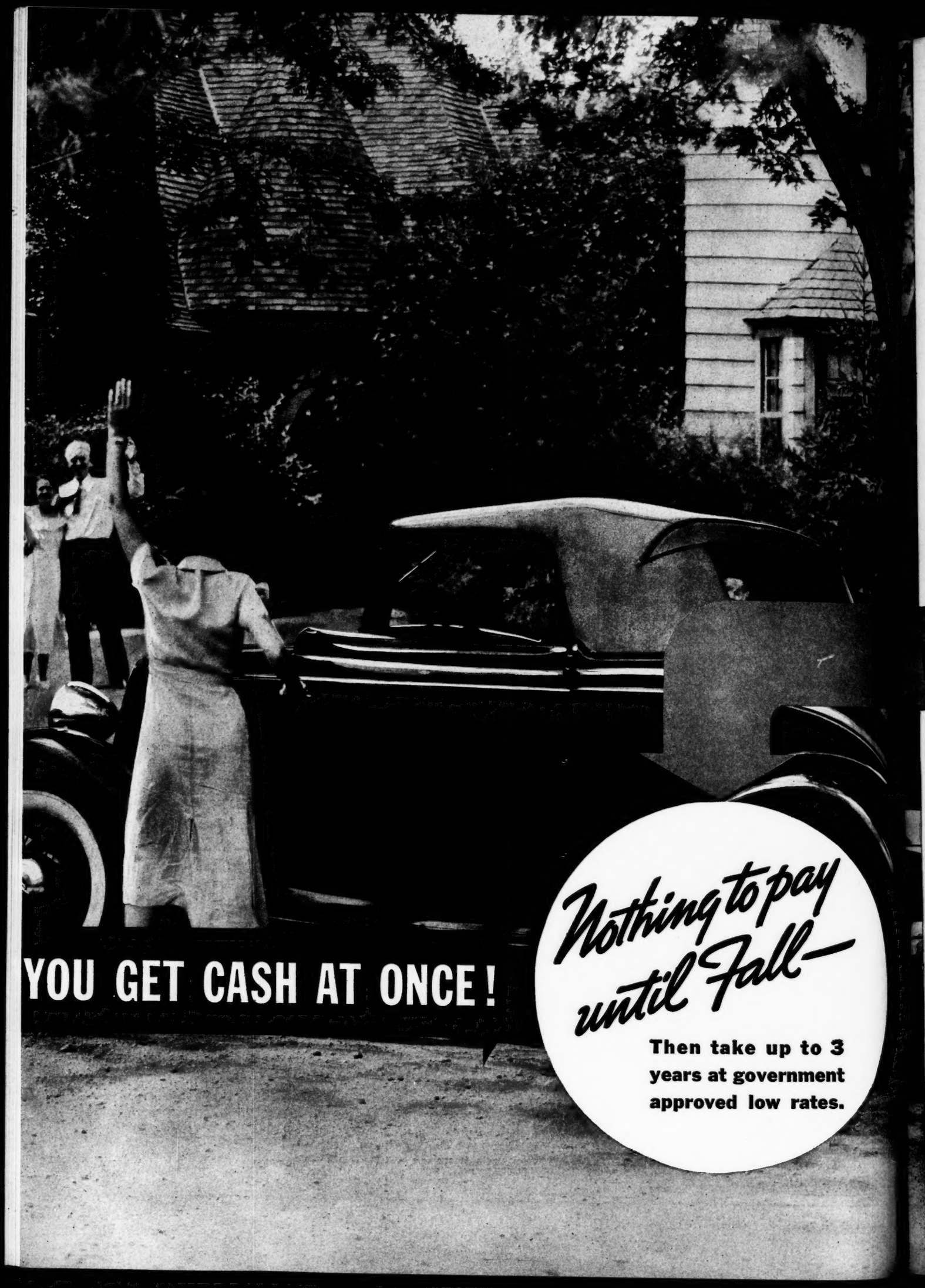
ST. LOUIS—R. W. Baker, Republic Steel Corporation, was the principal speaker at a special meeting of the Associated Sheet Metal, Air Conditioning and Heating Contractors of St. Louis, held at the Mt. Moriah Temple, June 10. Approximately 150 attended the meeting.

A.C. for Dress Shop

HARRISBURG, PA. — The Mary Sachs shop, exclusive women's wear store, has installed a complete Auditorium air conditioning system. Herre Brothers of this city, licensed Auditorium agents, made the installation. The architects were Lawrie & Green of this city, and the engineer was Charles Leopold, Philadelphia.

Forms A. C. Division

DES MOINES — The Des Moines Steel Co., 421 S.W. 4th Street, has formed an air conditioning and refrigeration division to sell, design, and erect air conditioning and refrigerating plants of all sizes excepting domestic types, in Iowa. It is a distributor for Frick and Trane equipment. John K. Dunn is manager of the newly-formed division.


YOU GET CASH AT ONCE!
Nothing to pay until Fall—
Then take up to 3 years at government approved low rates.

Sell them on having heating installed while the family is on a vacation . . .

. . . with the American Radiator Summer Finance Plan

WHAT are seasons to a plan like this? What home owner can resist this simple, easy way to solve next winter's heating problem *now?* Tell him about present low prices. Tell him he *pays nothing until Fall*—pays no interest or extra charges for the summer. Then, beginning in the Fall, he takes up to three years to pay at government-approved low rates.

Convenient? Sure. The work can be done while the family's on vacation. No fuss, no bother—and modern heating is ready at the first sign of winter. Everything he wants in heating is included. No extras, no strings.

Profitable? You bet! You get paid in cash when the job is completed. You get your full price at once, without recourse, without holdback. You pay no legal fees, no collection fees, nothing. It's a spot cash sale for you. Don't let summer put you in the red. You're in business 12 months a year. Do business every month with American Radiator's Cash-to-the-Contractor Finance Plan. Just drop a letter or a postcard for the details.

AMERICAN RADIATOR COMPANY

Division of AMERICAN RADIATOR & STANDARD SANITARY CORPORATION

40 West 40th Street, New York, N. Y.

NEWS OF THE MONTH

WITH THE MANUFACTURERS • • • •

American Radiator Co., New York, has appointed John E. King, assistant treasurer since 1927, as treasurer, succeeding Donald M. Forgan, who will continue with the company in his position as vice-president. Henry L. Weimer, assistant treasurer of American Radiator and Standard Sanitary Corporation, which owns American Radiator Company, has been made a vice-president of the latter.

Combustion Engineering Company, Inc., 200 Madison Ave., New York, announces that its directors have elected F. H. Rosencrants a vice-president, effective June 1. He assumed charge of the proposition engineering department. Mr. Rosencrants for a number of years was mechanical engineer with the Electric Bond and Share Company and later chief engineer of International Combustion, Ltd. of England.

Inland Steel Co., First National Bank Building, Chicago, has appointed Charles R. Robinson as first vice-president and general manager of sales. Mr. Robinson succeeds Edward M. Adams, who died May 8. Mr. Robinson was associated with Inland Steel Company from 1904 to 1908, and from 1922 until the present time. He is a director of the company, and has been vice-president in charge of the railroad sales department. He is also president of the Inland Tar Company, a subsidiary of Inland Steel Company.

The Insulite Co., 1100 Builders Exchange Building, Minneapolis, Minn., has appointed M. C. Fairfield as advertising agent to succeed H. H. Strobusch, resigned. Mr. Fairfield was for five years advertising manager of Flaxli-num Insulating Company.

The Kennedy Valve Manufacturing Co., Elmira, N. Y., has appointed Thomas G. Swope as its Texas and Louisiana representative, with headquarters at 863 Fifth St., Beaumont, Tex.

National Radiator Corp., Johnstown, Pa., has opened sales headquarters for its newly created oil heating division at 101 Park Ave., New York. The offices will be maintained as central headquarters for the division's distribution activities and will be under the direction of C. P. Culbert, manager.

John J. Nesbitt, Inc., Holmesburg, Philadelphia, Pa., announces that H. Berkley Hedges, who has been affiliated with the heating and ventilating industry since 1914, has joined the company as manager of industrial sales. Upon being graduated from the University of Kentucky in 1914, Mr. Hedges was with the engineering department of the Buffalo Forge Company, later being transferred, as a sales engineer, to its Philadelphia office. He was for several years sales engineer for the Carrier Engineering Corporation in its Philadelphia office, and during the war and for three years following, was associated with E. I. duPont de Nemours and Company, Wilmington, Del., as a heating end ventilating engineer. In 1921 he estabished a direct sales office in Philadelphia for Kewanee Boiler Company.

H. Berkley Hedges.

In 1924 he was appointed New York district manager for York Heating and Ventilating Corporation, and served in that capacity, and as a director of the company, until 1931.

Owens-Illinois Glass Co., Toledo, Ohio, has promoted Stanley J. McGiveran to the position of manager of sales-merchandising. He was formerly manager of the prescription ware division.

W. M. Gates, who has been manager of the statistical and inventory control division, has been made assistant to the general sales manager. Mr. McGiveran and Mr. Gates will also retain the managerships of their respective divisions.

Penn Electric Switch Co., Des Moines, Ia., has appointed Burton E. Shaw, head of the research division of Gilbert & Barker since 1932, as sales engineer. Mr. Shaw is a graduate of New York University and Yale and a former instructor in heating and ventilating at N.Y.U.

Republic Steel Corp., Youngstown, Ohio, has moved its Buffalo, N. Y., district sales office from 475 Abbott Road to 1020 Liberty Bank Building. T. B. Davies continues in charge of the office as district sales manager, assisted by his present staff.

C. J. Tagliabue Mfg. Co., Brooklyn, N. Y., announces the appointment of E. D. Wacker, as assistant general sales manager. Mr. Wacker has been with the company for 11 years, part of the time as manager of the Pittsburgh territory and more recently as division sales manager in charge of controller sales for domestic refrigerators.

COMING EVENTS

OCTOBER 14-18, 1935. *Seventeenth Annual Convention of the American Gas Association, Chicago, Ill.*

JANUARY 27-31, 1936. *Fourth International Heating and Ventilating Exposition, International Amphitheatre, Chicago, Ill.*

McAlear Marries

CHICAGO—James McAlear, president of The McAlear Mfg. Company, was recently married to Mrs. Alfred Walsh, a member of one of the pioneer Chicago families, the daughter of the late John W. Garvey, and socially prominent.

Three 1934 A.C. Jobs in Syracuse

SYRACUSE — There were three air conditioning installations made in this city in 1934, according to Ralph L. Manier, industrial heat engineer, The Syracuse Lighting Company, Inc. One installation was a 10-hp. job in a broadcasting studio and the other two were installed in ladies' apparel shops and consisted of one 10- and one 12-hp. installations.

Isaac H. Francis

PHILADELPHIA—Isaac Hathaway Francis, 1520 Locust Street, one of the best known consulting engineers in the east, died here June 26.

Ice Subject of Meeting

NEW YORK—Clifford F. Holske, research engineer, Knickerbocker Ice Company, talked on the technical aspects of the ice problem at the June 13 meeting of the local section of the ASRE. G. L. Andre spoke on problems of the ice industry, and C. J. Andrews discussed marketing ice-using equipment.

Engineers and Contractors Outline Ideas on Federal Construction

(Concluded from page 40)

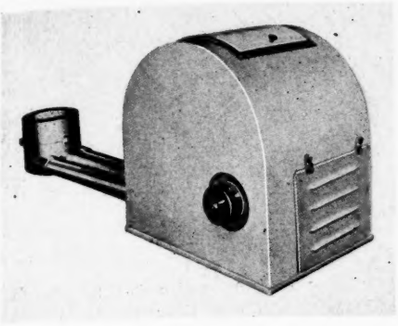
preserve and enhance the existing normal system of producer to wholesaler to contractor to consumer.

However, if for certain conditions and reasons, direct bulk purchase by government procurement offices is found to be necessary, the government should restrict their centralized purchase to a few standard items in carload lots. The government should also deal with an industry as a unit through its recognized trade associations or code authority, and not attempt to break down by improper measures either the distribution system or the current competitive price structure.

Advisory

A national advisory body, representative of the construction industry should be established by the President to aid and advise the administration in the formulation of broad policies and procedure to the extent that the work-relief program utilizes construction as a means of accomplishing its purpose.

NEW EQUIPMENT



Sidney Stoker.

Sidney Automatic Stokers

Stoker Equipment Co., Sidney, Ohio, has on the market two bituminous coal stokers for installation in domestic and small commercial and industrial boilers and furnaces. The domestic model has three coal feeds, 15, 35, and 50 lb. per hr. of coal while the commercial unit feeds 100 lb. per hr.

According to the manufacturer both stokers have the following special features: fully enclosed sheet steel hopper holding 400 lb. of coal, gear case with only three moving parts all of which operate in a bath of oil, a retort made of heat resisting iron with a removable tuyere top, special steel coal feed worm, aluminum fan of multivane type with an adjustable air damper, noiseless direct connected ¼-hp. electric motor.

Four automatic controls, a room thermostat, a stoker switch, limit control and a pilot control, are standard equipment.

Trane Comfort Cooler

The Trane Co., La Crosse, Wis., has announced a small comfort cooler. The feature is its low cost, as it is to be marketed for as little as $70.

The lowest-priced models require a cold water supply from city mains or from wells at temperatures below 60°. Other mode's operate on direct expansion refrigerants.

G. E. Air Circulator

An improved air circulator, type HV-1B, specially designed for efficient and quiet operation, has been announced by the General Electric Co., Schenectady, N. Y. It consists of a motor mounted on a resilient base and a directly connected aphonic pressure-type propeller fan with orifice, all assembled in a sturdy cabinet finished in durable gray.

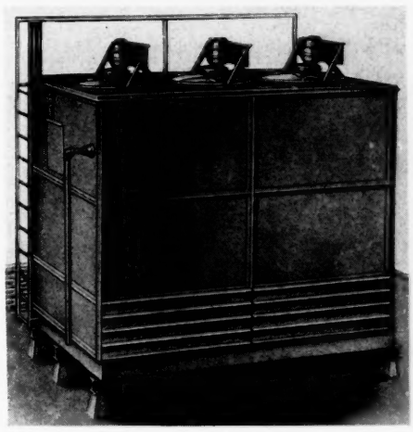
When connected to a 110-volt, 60-cycle power supply, it is said that it will deliver, depending on the back pressure, from 2200 to 2900 c.f.m. of air, with a corresponding power input of from 260 to 210 watts.

Binks Cooling Tower

Binks Mfg. Co., 3114 Carroll Ave., Chicago, has announced a line of induced draft cooling towers with capacity ranging from 5 to 200 g.p.m. These are recommended for refrigeration plants having from one to 50 tons refrigeration capacity.

Water distribution is through low pressure Rotojet nozzles. The nozzles spray a finely atomized mist of water downward through upward currents of air induced by the fan assemblies placed at the top of the tower. During cool weather, where towers are required for year round operation, the fans may be shut off and cooling capacity secured without their use.

Depending upon tower size and capacity, one or more fans are used, the fans being driven by individual splash and weatherproof motors at speeds of approximately 450 r.p.m. All towers of the type K series are constructed of heavy steel frame surrounded by a sectional copper-bearing galvanized steel housing asphalted aluminum painted inside and out before shipment.



Binks cooling tower.

Tag Throttling Top for Diaphragm Valves

C. J. Tagliabue Mfg. Co., Park and Nostrand Aves., Brooklyn, N. Y., has developed the Tag long range throttling top in connection with its line of diaphragm valves. A feature is the arrangement for adjusting the spring pressure. The member in contact with the bottom of the spring does not turn when the adjusting feed screw is turned but, guided by the two vertical fins of the spider arms, merely moves up or down. Thus spring adjustment, it is claimed, does not tend to wind up the spring or disturb its normal characteristics in any way.

Link-Belt De Luxe Stoker

The No. 7 size, de luxe model automatic coal burner for household use has been placed on the market by Link-Belt Co., Chicago.

The stoker is 8 in. longer than the No. 7 standard; has a high-gloss maroon finish with special striping; has a sectional rectangular retort similar to those furnished on large stokers, with inside and outside air ports; cast aluminum fan with "air stream" inlet control, and other features.

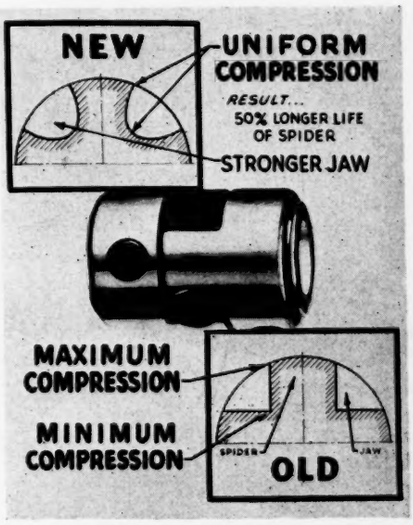
L-R Type IA Flexible Coupling

The L-R type IA flexible coupling, announced by the Lovejoy Tool Works, 5022 West Lake St., Chicago, introduces what is said to be a new feature in the principle of transmission of torque through resilient cushioning arms of a spider subject to compression. Instead of using the conventional parallel jaw surfaces where the outer edges of the jaws bear on the cushioning spider, the type IA coupling has convex jaw surfaces that exert a rolling pressure when bearing on the spider arms.

Utilizing the variation of compressibility with the thickness depending upon the resilient cushioning materials used, the convex surfaces proportion the spider arms so that the compression is substantially uniform, regardless of the extent to which each portion is compressed, so that each portion of the arm bears an equal share of the load.

Other features include a three-part construction.

The couplings are made in standard sizes with bores from ¼ in. to 3 in., to transmit from 1/12 to 200 hp. at 1750 r.p.m.



L-R flexible coupling.

Alco Thermo Valves

Alco Valve Co., Inc., 2628 Big Bend Blvd., St. Louis, has introduced the types N-375 and T-500 thermo valves for Freon and methyl chloride. They are designed automatically to regulate the flow of liquid refrigerant to any evaporating coil according to the refrigeration load that may exist at any time. Actuated only by the superheat of the refrigerant as it leaves the evaporator, the valves react rapidly to load changes and, if properly selected for capacity and properly installed, are said to maintain maximum efficiency in any refrigerated low side regardless of how many similarly equipped low sides may be refrigerated by one compressor.

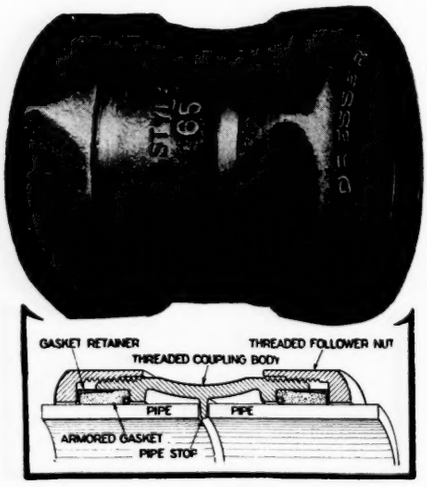
Type N-375 is made for any specified capacity up to 5 tons with Freon and up to 10 tons with methyl chloride. Type T-500 is available in capacities from 5 to 10 tons for Freon and 10 to 20 tons for methyl chloride.

Dresser Pipe Coupling

Several unusual features are incorporated in a self-contained pipe joint announced by the S. R. Dresser Mfg. Co., Bradford, Pa. To make a connection with the new joint, called the Dresser style 65 compression coupling, the pipe ends are inserted into the coupling, which comes assembled, and then two threaded octagonal nuts are tightened.

As the nuts are tightened, two resilient armored gaskets are compressed around the pipe. The resulting joint, it is claimed, is permanently tight and absorbs normal vibration, expansion and contraction. The pipe need not be cut to exact lengths, and repairs on old lines can be easily made.

The couplings are supplied, black or galvanized, in standard steel pipe sizes from ⅜ in. I.D. to 2 in. I.D. inclusive.



Dresser pipe coupling.

Century Motors for A.C.

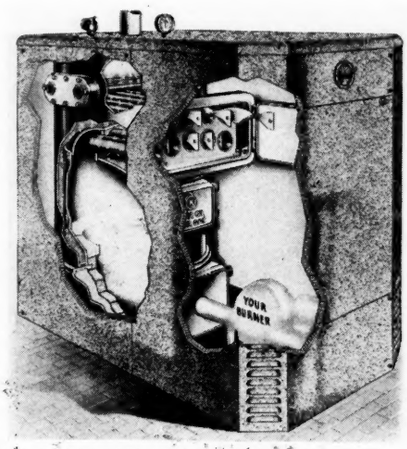
Century Electric Co., St. Louis, has announced a line of squirrel cage normal torque and high torque motors designed for refrigeration and air conditioning application.

The designers claim for this line a composite performance of torque, efficiency, power factor, and quiet operation which is best suited to the operation of this type equipment, including the latest designs of compressors.

These motors are available in sleeve or ball bearing designs and are available in sizes 600 hp. and smaller.

Kewanee Jacketed Boiler

Kewanee Boiler Corp., Kewanee, Ill., has introduced the Regal jacketed



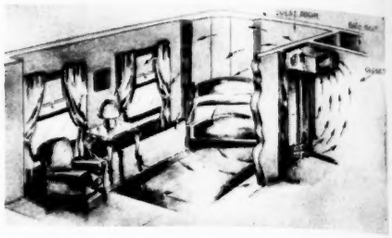
Regal residence boiler.

round residence boiler. The jacket is designed to accommodate the boiler and a gun type burner. The boiler and burner are both accessible by lifting a removable coil from the encasement. The illustration shows a cutaway view.

The company also has a square jacketed round boiler designed for rotary burners entirely enclosed or external assembly with gun type burners.

Vibration Eliminator

The Vibration Eliminator a shock absorber or cushion for machinery, has been introduced by the Vibration Eliminator Co., 41-26 37th St., Long Island City, N. Y. The device consists chiefly of a base stamping and supporting housing to which the leg or base of the machine may be rigidly fastened. The Vibration Eliminator relies for its efficiency chiefly upon a new table of selected loadings on pure natural cork. According to the manufacturer, adequate loadings and ease of installation previously difficult to secure may now be assured in every installation. Models are available for a large number of loadings.



Cutaway of hotel room showing one application of a hotel unit.

Frigidaire Hotel Conditioners

Four low side units for air conditioning are announced by Frigidaire Corp., Dayton, designed and produced after a survey of air conditioning needs in hotels, club quarters, and similar applications. These units are said to provide practically all the advantages of the concealed duct systems for those places in which use of ductwork would not be practicable or desirable.

The new models are intended primarily for installation inside of closets, bathrooms, or other small spaces adjoining the guest sleeping or living rooms. Here they may be placed at the right point overhead and out of the way of the curious guests. Grilled openings to the room admit the conditioned air and return air is taken to the unit directly through other grilled openings in walls or through louvers or grilles in closet doors.

They may also be used in connection with short localized duct systems wherever necessary to make installations more practicable.

To provide a wide range of versatility these air conditioners are available in two distinct types each of which is produced in both 1-ton and ½-ton capacities. The series HU50 and HU100 are low in design and provide for return air through the rear, while models HU51 and HU101 are of the vertical design with provision for return air through the lower end of the front panel. This front opening can be grilled directly or be placed adjacent to wall openings which are fitted with louvers, grilles, or screens. Both 1-ton units are equipped with double centrifugal blowers and the ½-ton units have single blowers.

Ridgid Tubing Cutter

Ridge Tool Co., Elyria, Ohio, has announced a new and improved Ridgid tubing cutter that combines both light weight and a wide margin of strength. Made for ¼ to 1 in. tubing the cutter weighs 6½ oz. and is 5½ in. long when set for ¼ in. tubing. Accurate right angle cuts are made, it is claimed, because the cutting wheel and V-pad are at the center of the tubing and the solid screw saddle must move in a straight line. It is equipped with an integral reamer.

BEFORE YOU DECIDE ON ANY *Air Conditioning* FRANCHISE

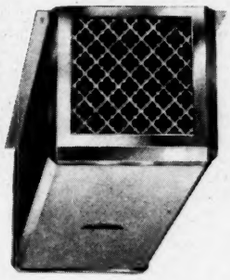
GET THE FAIRBANKS-MORSE PROPOSITION *first*

All the world loves a winner . . . not only because the winners stay ahead of the field, but because winners pay profits!

Before you decide upon any air conditioning franchise, look beyond the printed profit percentages that will be offered you. Look beyond the usual claims of a superior line, of more acceptance for the equipment. Find out about the manufacturer . . . his policies . . . how he protects and helps his dealers . . . his success, not only in air conditioning, but in the design and sale of his other products that are distributed through dealers and distributors.

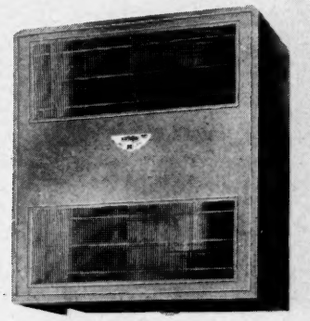
The Fairbanks-Morse Ortho-Clime Air Conditioning Franchise covers *more* than just a line of equipment to sell. It covers motor, compressor and unit design second to none . . . a century of precision manufacture . . . the experience and the facilities for building a first-quality line. And beyond these, it carries the prestige and the acceptance gained by Fairbanks-Morse products in every field of industry.

There is still room for a few alert distributors and dealers. For full information on the complete line and the F-M proposition, mail the coupon. Fairbanks, Morse & Co., Air Conditioning Division, 900 S. Wabash Ave., Chicago, Illinois.



Ceiling model ORTHO-CLIME —also available for wall mounting.

Floor model ORTHO-CLIME. Handsome in appearance, efficient in performance.



Large capacity wall model ORTHO-CLIME.

A STATEMENT OF POLICY

Fairbanks-Morse Air Conditioning equipment is and will be sold only through distributors and dealers. Under no condition will it be sold direct to consumers.

Fairbanks, Morse & Co.

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900 S. Wabash Ave., Chicago, Illinois
Please mail me ( ) free booklet on F-M Ortho-Clime air conditioners
( ) information on the F-M franchise.

Name.....

Organization.....

Address.....

City.....State.....

FAIRBANKS-MORSE *Air Conditioning*

Degree-Days and Unit Fuel Consumption—May, 1935

Continuing HEATING AND VENTILATING's seventh year of publishing degree-day data for various large cities in the United States

	Atlanta	Baltimore	Birmingham	Boston	Buffalo	Chicago	Cincinnati	Cleveland
Degree-days for May, 1935.....	8	140	4	318	484	401	198	372
Degree-days, Sept. 1, '34 to May 31, '35	2764	4371	2305	6324	6874	6133	4685	5799
Degree-days, Sept. 1, '33 to May 31, '34	2850	4773	2279	6466	7353	6081	5052	6183
Degree-days, Sept. 1 to May 31, Normal	2890	4533	2352	6045	6810	6290	4703	6155
Lb. coal per sq. ft. rad., May, 1935.....	0.064	1.120	0.032	2.544	3.872	3.208	1.584	2.976
Gal. oil per sq. ft. rad., May, 1935.....	0.005	0.096	0.003	0.218	0.332	0.275	0.136	0.255
Cu. ft. gas per sq. ft. rad., May, 1935..	0.77	13.44	0.38	30.53	46.46	38.50	19.01	35.71

	Denver	Des Moines	Detroit	Duluth	El Paso	Fort Wayne	Grand Rapids	Harrisburg
Degree-days for May, 1935.....	457	292	394	530	69	310	359	209
Degree-days, Sept. 1, '34 to May 31, '35	5177	6143	6047	9275	2147	5981	6457	5311
Degree-days, Sept. 1, '33 to May 31, '34	4243	5941	6818	9628	1940	6341	6897	5754
Degree-days, Sept. 1 to May 31, Normal	5874	6384	6490	9245	2428	5934	6535	5375
Lb. coal per sq. ft. rad , May, 1935.....	3.656	2 336	3.152	4.240	0.552	2.480	2.872	1.672
Gal. oil per sq. ft. rad., May, 1935.....	0.313	0.200	0.270	0.363	0.047	0.213	0.246	0.143
Cu. ft. gas per sq. ft. rad., May, 1935..	43.87	28.03	37.82	50.88	6.62	29.76	34.46	20.06

	Hartford	Indianapolis	Kansas City	La Crosse	Los Angeles	Louisville	Memphis	Milwaukee
Degree-days for May, 1935.....	269	239	196	322	112	143	49	453
Degree-days, Sept. 1, '34 to May 31, '35	6087	5122	4622	7228	1282	4041	2740	6867
Degree-days, Sept. 1, '33 to May 31, '34	6483	5489	4369	7121	834	4400	2886	6774
Degree-days, Sept. 1 to May 31, Normal	6036	5298	4852	7322	1504	4180	2950	7206
Lb. coal per sq. ft. rad , May, 1935.....	2.152	1.912	1.568	2.576	0.896	1.144	0.392	3.624
Gal. oil per sq. ft. rad., May, 1935.....	0.184	0.164	0.134	0.221	0.077	0.098	0.034	0.311
Cu. ft. gas per sq. ft. rad., May, 1935..	25.82	22.94	18.82	30.91	10.75	13.73	4.70	43.49

	Minneapolis	New Haven	New Orleans	New York	Oklahoma City	Omaha	Peoria	Philadelphia
Degree-days for May, 1935.....	316	265	—	220	135	269	288	182
Degree-days, Sept. 1, '34 to May 31, '35	7619	5801	948	5262	3127	5676	5719	4746
Degree-days, Sept. 1, '33 to May 31, '34	7587	6239	854	5673	3131	5377	5814	5016
Degree-days, Sept. 1 to May 31, Normal	7850	5895	1024	5347	3613	6131	6109	4855
Lb. coal per sq. ft. rad., May, 1935.....	2.528	2.120	—	1.760	1.080	2.152	2.304	1.456
Gal. oil per sq. ft. rad., May, 1935.....	0.217	0.182	—	0.151	0.093	0.184	0.197	0.125
Cu. ft. gas per sq. ft. rad., May, 1935..	30.34	25.44	—	21.12	12.96	25.82	27.65	17.47

	Pittsburgh	Portland, Ore.	Providence	Reading	Rochester	St. Louis	Salt Lake City	San Francisco
Degree-days for May, 1935.....	215	223	276	222	391	162	307	224
Degree-days, Sept. 1, '34 to May 31, '35	5030	4007	6033	5236	6627	4289	5281	2328
Degree-days, Sept. 1, '33 to May 31, '34	5722	3162	6005	5582	7109	4426	3967	2004
Degree-days, Sept. 1 to May 31, Normal	5235	4379	6014	5389	6732	4585	5555	2682
Lb. coal per sq. ft. rad., May, 1935.....	1.720	1.784	2.208	1.776	3.128	1.296	2.456	1.792
Gal. oil per sq. ft. rad., May, 1935.....	0.147	0.153	0.189	0.152	0.268	0.111	0.211	0.154
Cu. ft. gas per sq. ft. rad., May, 1935..	20.64	21.41	26.50	21.31	37.54	15.55	29.47	21.50

	Scranton	Seattle	Spokane	Syracuse	Toledo	Trenton	Washington, D. C.	Wichita
Degree-days for May, 1935.....	333	259	282	389	351	226	142	183
Degree-days, Sept. 1, '34 to May 31, '35	6217	4226	5892	6686	6126	5312	4430	4166
Degree-days, Sept. 1, '33 to May 31, '34	6560	3657	4861	7099	6499	5783	4785	3908
Degree-days, Sept. 1 to May 31, Normal	6129	4716	6274	6881	5893	4933	4626	4673
Lb. coal per sq. ft. rad., May, 1935.....	2.664	2.072	2.256	3.112	2.808	1.808	1.136	1.464
Gal. oil per sq. ft. rad., May, 1935.....	0 228	0.178	0.193	0.267	0.241	0.155	0.097	0 125
Cu. ft. gas per sq. ft. rad., May, 1935..	31.97	24.86	27.07	37.34	33.70	21.70	13.63	17.57

Fuel consumption figures given above are based on certain conditions, and for other conditions corrections must be made. The figures assume the use of steam radiators emitting 240 B.t.u. per sq. ft. per hr., a system operating at 100% efficiency, and radiators calculated for maintaining 70° in zero weather. Heating values assumed for the fuels are 12,000 B.t.u. per lb. for coal, 1000 B.t.u. per cu. ft. for gas, and 140,000 B.t.u. per gal. for oil. To correct for other heating values, efficiencies, and design conditions, follow the method explained in the "Heating and Ventilating Degree-Day Handbook."

A Whitlock-Everdur Heater can Cure this Trouble and Provide Work for the Engineer and Contractor!

An unsatisfactory hot water supply is one cause of tenant dissatisfaction. Empty space brings no revenue. Modernization becomes a necessity.

The most modern hot water equipment is a Whitlock EVERDUR Heater—a Type K Storage Heater with a shell of that corrosion proof alloy. It can be sold to the building owner or manager on two sound economical facts:

1. It will produce the clean hot water tenants have a right to expect, and
2. It will never have to be replaced since it cannot corrode.

With only so much money available for modernization, alert Heating Engineers and Contractors will realize that the Whitlock Everdur Heater offers an ideal entering wedge for a share of this business. The nearest Whitlock Engineer will gladly cooperate —write for Bulletin 45, too.

THE WHITLOCK COIL PIPE CO., 40 South Street Hartford, Conn.

Consult the telephone directory for local address in

New York	Chicago	Baltimore	San Francisco
Boston	Detroit	Charlotte	Cincinnati
Philadelphia	Kansas City	Los Angeles	and other principal cities.

In Canada address Darling Bros., 120 Prince St., Montreal.

WHITLOCK HEAT TRANSFER EQUIPMENT

There are QUICK PROFITS *in Tank Heater Installations*

Install the METAPHRAM H-3 REGULATOR FOR TANK HEATERS

A new regulator of real "National" quality and dependability at a low price in keeping with the job it is designed to handle. Ask for prices and hook-up diagram which insures absolutely automatic and gradual control of all types of coal-fired tank heaters.

Full Stock carried in New York, 210 E. 45th St.

NATIONAL REGULATOR CO.

2309 KNOX AVENUE, CHICAGO

"We Find CHACE Accurate and Reliable"

The SONNER BURNER CO.

The SONNER DOMESTIC CONVERSION BURNER

Chace Thermostatic Bimetal is the active element that automatically governs operation of safety pilot light valve on Sonner Burners. By this control the fuel supply to main burner is shut off in the event that pilot light is extinguished.

Chace Thermostatic Bimetal is now used in every line of industry where automatic control of temperature is called for, or where automatic action must take place with change in temperature.

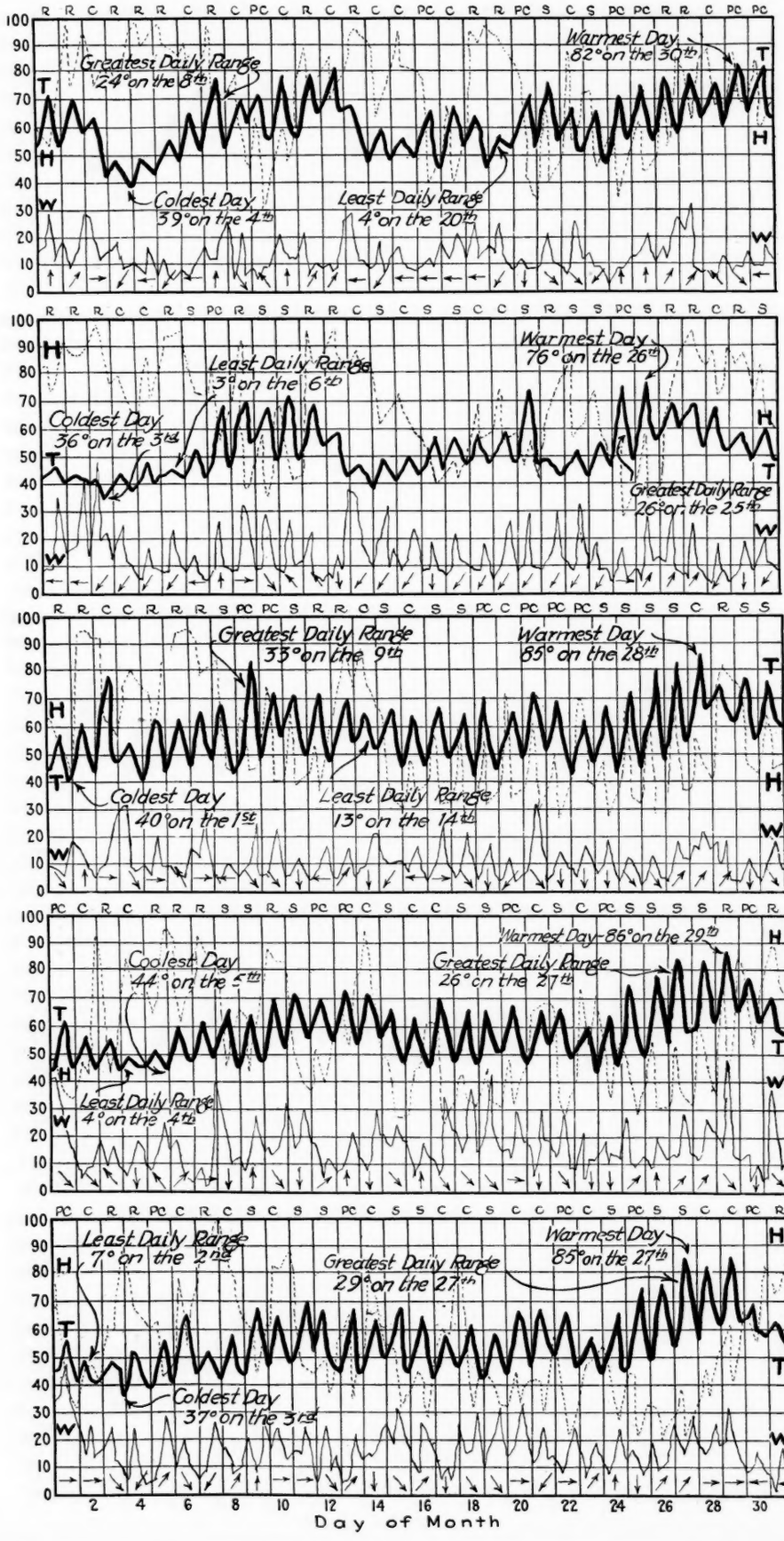
CHACE THERMOSTATIC BIMETAL "It Bends with the Heat"

W. M. CHACE VALVE CO.

1606 Beard Ave.

THE WEATHER FOR MAY, 1935

Plotted from records compiled for HEATING AND VENTILATING by the U. S. Weather Bureau. Heavy curves (T), dry bulb temperatures in deg. F.; dotted lines (H), per cent relative humidity, from readings at 8 a.m., noon, and 8 p.m., except for New York, which shows hourly readings. Light lines (W), wind velocity in m.p.h. Arrows indicate prevailing wind directions. S—clear; PC—partly cloudy; C—cloudy; R—rain; Sn—snow.


Greatest Daily Range 24° on the 8th
Warmest Day 82° on the 30th
Coldest Day 39° on the 4th
Least Daily Range 4° on the 20th
Least Daily Range 3° on the 6th
Coldest Day 36° on the 3rd
Warmest Day 76° on the 26th
Greatest Daily Range 26° on the 25th
Greatest Daily Range 35° on the 9th
Warmest Day 85° on the 28th
Coldest Day 40° on the 1st
Least Daily Range 13° on the 14th
Coolest Day 44° on the 5th
Warmest Day 86° on the 29th
Greatest Daily Range 26° on the 27th
Least Daily Range 4° on the 4th
Least Daily Range 7° on the 2nd
Greatest Daily Range 29° on the 27th
Warmest Day 85° on the 27th
Coldest Day 37° on the 3rd
Day of Month

St. Louis

Mean temp. for month, 61.4°; aver. wind velocity, 11.2 m.p.h.; prevailing direction of wind, E.

Chicago

Mean temp. for month, 52°; aver. wind velocity, 10.5 m.p.h.; prevailing direction of wind, N.E.

Pittsburgh

Mean temp. for month, 58.8°; aver. wind velocity, 9.3 m.p.h.; prevailing direction of wind, N.W.

New York

Mean temp. for month, 58.8°; aver. wind velocity, 14.3 m.p.h.; prevailing direction of wind, N.

Boston

Mean temp. for month, 55.5°; aver. wind velocity, 14.2 m.p.h.; prevailing direction of wind, W.

A Simple, Dependable FLOAT VALVE

THERE is no need to experiment with Float Valves of doubtful design when Davis can give you such a well proven valve. The simplicity of Davis Float Valves means accurate, reliable, trouble-free service! The perfected Davis design is a result of over fifty years experience in solving every kind of flow control problem.

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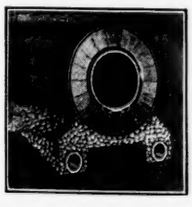

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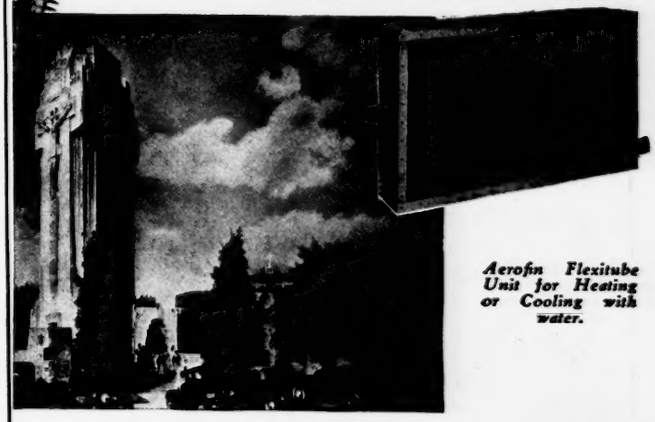

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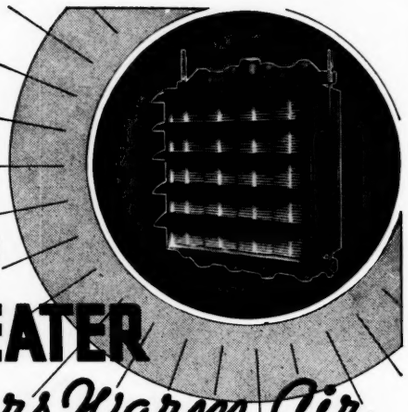

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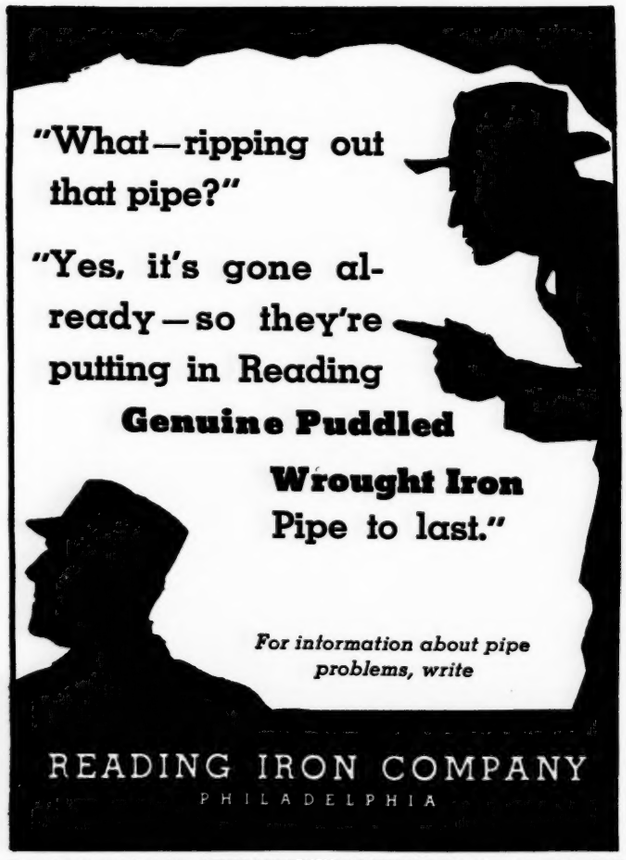

SCIENCE AND INVENTION HAVE NEVER FOUND A SATISFACTORY SUBSTITUTE FOR GENUINE PUDDLED WROUGHT IRON

The First Completely Air Conditioned Apartment House

(Concluded from page 23)

eral apartments were rented at once on the strength of the air conditioning feature.

It was made clear to early inquirers that if conditioning were to be furnished higher rentals would have to be charged. Apartment rentals, as they stand today, according to the superintendent of the building, are $120 monthly. While this might be considered high by some who are unaccustomed to the benefits of conditioned air, it is asserted that a great many prospective tenants have indicated their willingness to sign leases at the stated figure to obtain the advantages.

One observes that the landlord in this case did not follow the plan already in vogue with some other owners, that is, renting with or without air conditioning according to desire and willingness to pay for it. To explain this point, it might be said that many landlords now offer conditioning via portable floor cabinets if and when tenants wish to pay extra for it, but allow those who don't wish conditioning to sign leases at a lower figure.

Mr. Bernstein evidently considers that prospective tenants who do not wish conditioning enough to pay a little extra for it may find apartments elsewhere where conditioned air is not available. It is the owner's experience that there are many tenants who demand and appreciate conditioning.

To capitalize the air conditioning as a renting feature, across the front of the building is a large sign some 15 ft. by 20 ft. on which it is announced that this is the first apartment dwelling to be fully conditioned in New York. The dealer-contractor's name, that is, the United Air Conditioning Corporation, also appears in large letters along the bottom of the sign, thus providing publicity alike to the landlord and to the dealer.

Steam Jet Refrigeration Operating Results Suggest Methods for Further Economy

(Concluded from page 33)

be suitable at partial loads and of the better condenser conditions which exist at partial loads. Test data and experimental operation of several steam jet installations seemed to bear this out. A curve (not reproduced here) shows that computations indicate that jet velocity may be maintained constant with decreasing condenser pressure and reduced initial steam pressures.

Regarding actual means of accomplishing reduction of steam supply the authors believe that this reduction must be automatic if full advantage is to be taken of any improvement in condenser conditions. While there are several possible control points such as condenser pressure, condenser water inlet temperature and condensate temperature there are practical objections to using any of these to obtain operating control.

It appears to the authors that a differential pressure control on the whole offers greater possibilities in the way of improved sensitivity with decreased lag than would any thermostatic control. Such a method would also possess the ability to take advantage of beneficial

conditions in either the flash tank or the condenser. They point out that the difficulty of finding a representative point at which the average pressure can be determined in either the flash tank or condenser is real but believe that perhaps the use of a differential device will eliminate the necessity for determining either absolute values. The differential proposal (see Fig. 5) eliminates any necessity for barometric corrections.

Tests on an Industrial Unit Heater

(Concluded from page 39)

shown can be used for any entering air temperature desired. Since the coefficient of heat transfer is independent of the mean temperature difference, the effect of various entering air temperatures may be corrected by adjusting the steam temperature. Thus, dropping the entering air temperature 10° is equivalent to increasing the steam temperature 10°. To apply this to the curves an actual entering air temperature of 70° and 220° steam, one would use a steam temperature 10° higher, or 230°; also an entering air temperature of 90° and 220° steam. A steam temperature line 10° lower than 220° would be used, or a T_s curve for 210° steam.

The fourth objective of these tests was to determine the effect of superheated steam. The tests were run at various steam temperatures, having superheat up to 125°. These tests indicate that the effect of superheat is so slight as to be negligible and that the characteristics of the heater using superheated steam would be practically the same as if using saturated steam.

NEW CATALOGS

Commodore Heaters Corp., 11 West 42nd St., New York. Bulletin 8, an excellent 12-page, two-color publication on the built-in heater, for all kinds of room heating. The Simplex Convectofin system of single-pipe steam heating is explained. Also, Convector manufacturers certified capacity ratings are listed for the first time, for numerous combinations of heights and lengths for different heater sizes. Describes and illustrates the standard built-in heater for two-pipe steam systems. Dimensions of heaters are given, together with additional features of practical value in designing and installing piped-up heating systems.

Fedders Manufacturing Co., Inc., Buffalo, N. Y. A standard size, 12-page booklet made up of 11 articles dealing with refrigeration and air conditioning problems encountered in the field. The articles have been reprinted from the Fedders News and contain a considerable amount of technical information.

Hynes Electric Heating Co., 240 Cherry St., Philadelphia. Bulletin No. 9, describing the company's electric heating systems and automatic controls. Includes descriptions, illustrations, and engineering data on the company's electric room heaters, industrial heaters, blower heaters, and on dewpoint and other controls. Standard size, 12 pages.

Illinois Testing Laboratories, Inc., 141 West Austin Ave., Chicago. Bulletin 2129, standard size looseleaf-punched single sheet folder describing the company's Anor horizontal, edgewise pyrometer.

(Continued on page 78)

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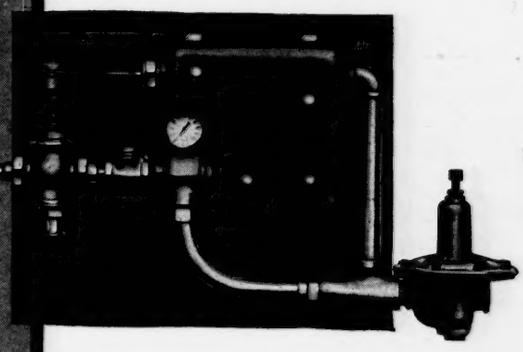

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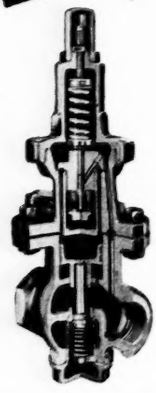

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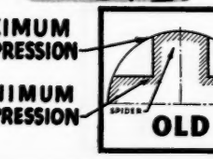

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Aug. 6	Rochester	Seneca		
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National Radiator Corp., Johnstown, Pa. A two-color, spiral bound, 20-page catalog entitled "Invisible Warmth," describing and illustrating the company's line of Aero convectors. The book includes a number of photographs of residences in which these convectors are installed.

National Radiator Corp., Johnstown, Pa. General catalog on National Premier steel boilers. Engineering and dimensional data, elevations, drawings and illustrations are included in the 28 pages of this standard size bulletin.

H. W. Porter & Co., 825 Frelinghuysen Ave., Newark, N. J., has published an exceptionally well-illustrated booklet, bulletin 351, fully describing its Therm-O-Tile underground steam conduit. The bulletin shows the advantages of this system, describes how work of installation is simplified, and claims that this system is durable and efficient. The monolithic sidewalk base, internal channel drain, arch and tile construction, tight and waterproof construction, and other points are featured. Eight pages, standard size.

Ross Heater & Mfg. Co., Inc., 1407-1411 West Ave, Buffalo, N. Y., has published five new catalogs as follows: Sterling Oil Section, form 1037; Ross Expansion Joint, form 1039; Arco Metal Pipe, form 1040; Ross Storage Tank Heater, form 1041; Ross Decalorator (steam jet refrigeration), form 1043

Scott-Newcomb, Inc., 1922 Pine St., St. Louis. A 50-page, standard-size book on general air conditioning calculations and duct layout. This book goes into detail on heat loss and heat gain calculations, details on the laying out of duct systems, and includes an original psychrometric chart designed by W. B. Shepperd, research engineer for the company. Contains numerous tables, including transmission coefficients, design temperatures for various parts of the country, both summer and winter, desirable condition indoors corresponding to the various outdoor conditions, and the pressure drop in ducts. Included are calculation forms, in which the data are arranged in a convenient form. Designed primarily for the company's dealers and distributors, but will be sold to others for $1 each.

Summerill Tubing Co., Bridgeport, Pa., has issued an unusually beautiful and complete catalog entitled Tubing by Summerill. Included in some of the chapters are instrument tubing for industrial pressure gauges, temperature control and recording equipment; pressure tubing such as is used in convectors; air heaters and similar applications, and fuel injector tubing. Complete specification data are given as well as a number of chapters devoted to formulas, tables, and mechanical composition data. Standard size, 56 pages.

C. J. Tagliabue Mfg. Co., Park and Nostrand Aves., Brooklyn, N. Y. Bulletin 1117 describing the company's line of Tag diaphragm valves and giving complete dimensions as well as instructions for sizing such valves. The bulletin is profusely illustrated with both photographs and graphs. Standard size, 16 pages.

The Trane Co., La Crosse, Wis. Catalog standard size, punched for insertion in binder, and entitled "Trane Fans." Describes, illustrates, and gives complete engineering information on the company's line of blowers. 24 pp.

The Trane Co., La Crosse, Wis. A four-page looseleaf-punched folder describing the company's suspended propeller type unit coolers. Capacities, dimensional data, and drawings are given. Standard size.

York Ice Machinery Corp., York, Pa. Three standard-size sheets describing the company's horizontal shell and tube brine cooler, horizontal shell and tube condenser, and vertical shell and tube condenser. Illustrates, describes, and gives engineering data relative to this equipment.

Young Radiator Co., Racine, Wis. Catalog no. 435 entitled "Young Heat Transfer Surfaces for Air Conditioning and Commercial Applications." Illustrates and describes the company's line of blast units and commercial cooling units. In addition, sample calculations, curves and tables are presented to aid the engineer in solving problems involving heat transfer. A Hill psychrometric chart is inserted in the back. In addition to being a catalog the bulletin is a valuable data book on the subject. The company has also published catalog no. 535, a four-page, standard-size bulletin which is supplementary to catalog no. 435. In this catalog are illustrated and described the company's line of evaporators used in connection with cooling and air conditioning.

Abstracts

(Concluded from page 60)

The six methods described are (1) without tables, (2) with cubic divisors, (3) the 2-20-200 rule, (4) with tables, (5) by the B.t.u. method and (6) with the decimal factors. Each method is described in detail and its application is illustrated by a practical example.

[*"Six Ways to Figure Radiation," edited by H. L. Alt. Published by Domestic Engineering Publications, 1900 Prairie Ave., Chicago. Imitation leather binding; 3¾ x 6½ in.; 64 pages; price, $2.*]

●

Bibliography on Coal and Coal Products

This bibliography of books and articles relating to coal and coal products should prove extremely valuable to all persons interested in the production or use of coal or any of its main products.

Besides listing books and articles in the English language concerning coal, the book also tabulates articles dealing with coal and related subjects, the publications of societies and technical institutes, and bulletins and reports of various universities and colleges. The proceedings and other publications of technical societies interested in coal are listed as are the reports of the various commissions on coal in the United States and Great Britain.

The book has been compiled by F. R. Wadleigh who was formerly chief of the Coal Division of the Department of Commerce and who served as Federal Fuel Administrator during 1922-23.

[*"A List of Books and Other Sources of Information Regarding Coal and Coal Products," compiled and published by F. R. Wadleigh, 1026-15th St., NW., Washington, D. C. Cardboard binding; 6 x 9 in.; 63 pages; price $1.*]

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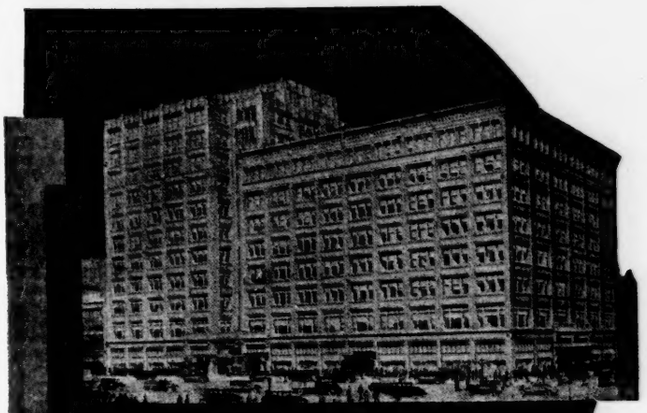
OXYGEN REMOVAL FROM WATER. The factors governing the rate of oxygen removal from water by sodium sulfite are shown to be the pH of the water, temperature, catalysts, and inhibitors present in the water. Sodium sulfite may be used to remove oxygen from boiler feed water with assurance that the reaction is immediately completed at temperatures found in the boiler or hot process softener. At outdoor temperatures the reaction is less rapid and time must be allowed for the reaction to be completed. The use of 0.1 p.p.m. copper sulfate (1 lb. in 1,200,000 gal.) will catalyse the reaction to completeness in 2 min. unless inhibitors are present. [*"Oxygen Removal from Boiler Feed Water by Sodium Sulfite," by K. Kobe and W. Gooding in the March, 1935 issue of Industrial and Engineering Chemistry, page 331.*]



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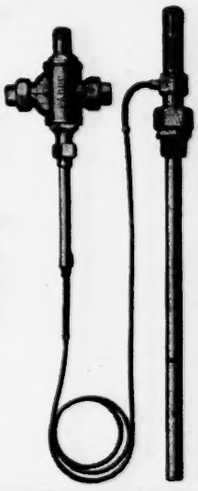

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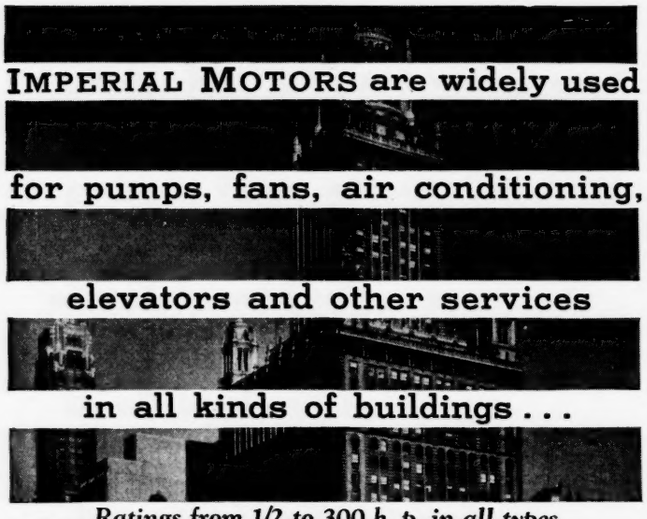
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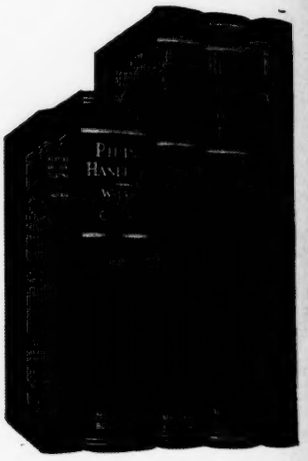

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